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The present Work is an enlarged edition of the "Outlines of a Course of Dissections," printed some years ago for the use of the Students of Anatomy at St. Thomas's Hospital. The plan therein recommended has been retained, from the conviction of its utility, founded on experience.

The Author takes this opportunity of presenting his acknowledgments to Mr. Astley Cooper for his corrections in the description of the Anatomy of Hernia, and for his permission to introduce into this work, copies of several of the plates relating to this subject from his works on Hernia.

The principal contents of Section IV. regarding parts connected with surgical practice, the Author regards as no more than an attempt to point out some of the important practical relations of Anatomy; but he hopes at some future time to give a more compleat view of this subject.

The Table of Contents has been purposely made large, in the hope that it will be found to facilitate the comprehension of the plan as a whole, while it supplies in great measure the means of reference to the several parts.

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BEING AT THE SAME TIME

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ERRATA.

Page 18, line 5, *for* mucle *read* muscle.
32, —— 2, *for* os meri *read* os humeri.
51, —— 1, *after* back *insert* part.
58, —— 7, *for* posticum *read* anticum.
—, —— 33, *for* ligamentnm *read* ligamentum.
63, —— 22, *for* adaption *read* adaptation.
64, —— 32, *for* membrani *read* membrana.
85, —— 12, *after* lamina of, *insert* medullary.
88, —— 16, *for* (p. 86) *read* (p. 90)
90, —— 3, *for* medullary *read* medulla.
106, —— 32, *after* os hyoides *insert* and.
113, —— 7, *after* with *insert* the.
119, —— 2, *for* sterno-hyoideis *read* sterno-hyoidei.
119, —— 3, *for* arterie *read* arteries.
148, —— 39, *for* " two lateral incisions which are" *read* " a lateral incision."
151, —— 15, *for* regions *read* region.
160, —— 33, *before* " at the" *insert* " are."
179, —— 5, *for* anch *read* inch.
188, —— 15, *for* peritoneal *read* peritonæal.
201, —— 1, *for* thyroideus *read* hyoideus.
323, —— 40, *after* not *insert* at.

INTRODUCTION.

Anatomy may be regarded either as an independent science, or as subservient to the purposes of medical and surgical practice; each therefore demanding for its acquirement a different mode, according as the one or the other may be the object of the student. The present work is appropriated to anatomy as adapted to practical uses, its aim being to point out all those objects which most require the attention of the beginner in this point of view.

From the different plans by which the ends above mentioned may be attained, we have selected the one which experience has led us to prefer as uniting the most important practical advantages. This union appeared most attainable by taking the mean between two extremes, that namely of being determined wholly by the local relations; and that of dividing the whole body into the several systems of muscles, vessels, nerves, &c. and of pursuing each by itself with an almost entire neglect of its relative positions to the parts of other systems. We have endeavoured to combine the advantages of both, by so far availing ourselves of the former, as not to neglect the blending of the structures which compose the different portions of the body, while we adhere to the latter in tracing the several components of its structure distinctly and separately; so as to prevent on the one hand the confusion that would arise in consequence of frequent and rapid transitions from one part to the other, and yet on the other hand to preserve a facility of re-combining the whole in the mind's view, while the relative positions are fresh in the memory.

Anatomy, like other sciences of experiment and observation, has become, by the industry of its cultivators, a collection of numerous, but too often insulated facts; and our ignorance of their meaning and connexion has become apparent in proportion to their number. This condition of the science has influenced its language:—names have been multiplied, which neither describe nor explain, and different names, that owe their introduction to the mere caprice of the individual anatomist have been applied to the same parts. Description has been exhausted, without adding to our knowledge, and without reference to the importance of structure and function.

The number of objects which must be attended to, in order to the acquirement of the necessary theoretical knowledge of medicine and surgery, is such that the greater part of the students, who visit the hospitals of the metropolis, can devote but little time to any single branch; and in addition to the theoretical part, the field of practice, which an hospital affords, claims a large portion of their time. But the state of the science, and the circumstances of the student, are not perhaps the greatest bars to improvement. The small progress too often found, and the perplexity of the student during that progress, are still more attributable to his want of previous information how to arrange the numerous but single facts which are offered to the mind; so that he is obliged to be seeking for a plan during the period he should have been acquiring the materials that are to fill it up; and by the time he has prepared it, the period allotted for his studies is expired.

It is in this respect that lectures are not only valuable but indispensable. In them a comprehensive idea is gained of the whole; and whilst the parts are displayed, their functions in the healthy state and the importance of particular structures are adverted to, with the changes which they undergo from morbid actions or from accident. Thus by forming the groundwork of physiological and pathological knowledge, the lecturer enables the student to pursue his anatomical labours intelligently.

But it must be recollected that lectures, however necessary, are only calculated to give general ideas; whereas it is required of the practitioner, that his knowledge should be particular and even minute. It is not sufficient that he is merely acquainted with the presence of certain parts, but he must know precisely their situation and extent. The surgeon's knife may give health or death within the space of one hair's breadth. This kind of knowledge is to be acquired by actual dissection alone. Idleness may persuade, and the natural aversion to the sight and touch of the dead, may inforce an opinion, that anatomy is to be gained at the cheap rate of turning over the unsoiling pages of a quarto, or learning by rote the names of muscles, arteries, or nerves, arranged in the convenient form of tables. The deception is not a little strengthened by the fallacious clearness which the art of the draughtsman and engraver, naturally interested in the *beauty* of the works, has given to those parts which the practical anatomist, more especially if a beginner, is at pains to discover, and often in vain labours to shew distinctly, much less to exhibit with elegance. These means indeed may give an outline of the systems of parts, and are as such valuable; but practical anatomy aims at much more. Its leading object is to gain a thorough acquaintance with Relative Position, —a knowledge, by means of which the mutual relation of all parts of the body may, as occasion shall need, be represented to the mind. It can only be acquired by separating the coverings of important parts, by observing the manner in which they lie embedded in the surrounding softer parts, and the prominent points which mark their situation, whether seen in the living state, or viewed by dissection. The parts must be seen as connected with one another; not as at a lecture, where the body is generally prepared to shew some single part, while every other which might obscure it is removed, in order to render it distinct in a large anatomical theatre.

The benefit and necessity of actual dissection does not, however, stop here: It would be well for the surgeon who intends to be a good operator, (and such, it is to be hoped, all do who undertake the profession), that he should dissect, in order to attain that dexterity essential to most, and praiseworthy in all, operations.

Minute dissection is frequently depreciated, or at best thought necessary for those only who profess anatomy as an independent science. It certainly is to be deprecated if it excludes more important occupation, or if the preference be given to the tracing of a minute fibril of a nerve, or ramification of a blood-vessel, while the relative position of the trunks is neglected. But barring the consideration that no part of the body is unimportant, minute dissection (as we have suggested) is of advantage in giving to the hand facility of motion and exact correspondence with the will. Neglect of dissection, of which the contempt of minute anatomy is but a symptom, is not, however, the evil of most common occurrence. It is more requisite to warn against the slovenly method of performing it, both from the imperfect impression which it may occasion at the time, and the injurious habits it may be the means of forming. Those so erring, should recollect that the diligence of the dissector is not to be estimated by the quantity dissected, but by the knowledge acquired and retained; and that, in the necessarily slow and tedious process of dissection, the sum of such knowledge as merits the name will be commensurate with the quantity of examination and the degree of observation and activity of the mind. Nor will the relative position of parts in the dead subject alone satisfy the zealous dissector, whose final aim is that of medical and surgical utility. He will extend his observations and comparison to the living body. The simple circumstances of handling the living or recent body, of feeling the hard parts through their coverings, of observing the form and motion of joints in this state, have been, as it would seem, too much neglected; but their advantages may be appreciated by those who have felt the difficulty of detecting unnatural conformation or figure, whether arising from disease or injury. An extensive opportunity of enlarging his comparative views, and one which should be cultivated by every means, is afforded in the dissecting-room by the inspection of bodies, and thus of learning to discriminate between the appearances of health and disease, and of ascertaining the changes which disordered functions or morbid actions produce in the form, colour, and texture of organs. Of the advantages which result from such observations to our knowledge of the causes, signs, seats, and treatment of disease, it is not here the place to treat.

These then are the chief benefits which are to be expected from dissection; and whilst the lectures give a comprehensive view of the subject, with the mutual relation and connexion of all its parts, and their application to practice, it is by dissection alone that such views become essentially our own, or that we dare give them the name of knowledge.

After having fixed the objects of inquiry, the next important and necessary step in the advancement of knowledge, is to determine the method of investigation. To this end the following considerations are recommended to the attention of the beginner:—He must depend for success entirely on his own exertions; and guard against the common error of supposing that his acquirements will be proportionate to the lessons of his teachers, if he give even attentive ear to them, without activity of mind: for he must recollect that the mind is by no means passive in the acquirement of knowledge, and that, to use the common but apt metaphor, before we have digested what is presented to our perception, we can on no account call it experience.—Every mind has something individual in its mode of receiving instruction, and of stamping form upon it. That which is presented to the mind, must be rendered consonant with it, assimilated, or in other words reduced to principle, before it can become an understood fact, or a fit maxim for conduct or judgment. In the eagerness for knowledge, he must be careful not to overburthen the mind, by heaping fact upon fact, without examination or principle, for it cannot retain more than it can arrange.

He should have a general conception of parts before he proceeds to their particular examination; he should not therefore attempt to dissect those parts which he has not seen displayed in the lectures or demonstrations. If invention were a quality frequently to be met with, such a rule might be dispensed with; but, fortunately or unfortunately, man is the creature of imitation and education: he may therefore lose his time, from groping in the dark, when he might have carried a light to the inquiry; and from his attempts having been repeatedly foiled he may become tired and disgusted with his employment. A general idea is to the young anatomist what a map is to a traveller in a strange country.

But the student, who should indiscriminately direct his attention to all the parts which are successively treated of in lectures or in books on anatomy, misled by the necessity, under which the writer or lecturer lies, of describing all parts, and almost with equal minuteness, will find, from insufficiency of time, that notwithstanding all the efforts he may have used, he is deficient in points which are essential in practice, whilst he has gained others for which he has no application. There is necessarily a choice of subjects to be made, as well as a plan to be pursued in their investigation: and although it is not meant that there are any parts of the body which are unworthy consideration, yet it is recommended that the leading points should be first mastered; and that afterwards, as time and opportunity may permit, the less important should be added.

Thus the student should commence with the bones: they ground, and in part predetermine, the scheme of relative position; they form a frame-work to all the softer parts; and in giving them figure and support, constitute the form of the body. From their unyielding texture, they may be readily distinguished by the touch, although hidden to the sight when surrounded by the softer parts; they therefore serve as a guide to these in the neighbourhood. The form of the ends of bones, with their means of adaptation to each other, is, perhaps, the most essential part of their study. An accurate knowledge of these assists greatly in the diagnosis of the often obscure fractures about joints, and is indispensably requisite in that of dislocations. In these cases particular attention is requisite to their figure, more especially when surrounded by the soft parts, to the prominent points which may be felt under such investments, to their capability of motion, to the strength of their articulation, as depending upon the form of the bones or cartilages, and the strength, number, and disposition of the ligaments. These circumstances, together with a knowledge of the muscles, explain the manner in which displacements occur, and the means of their reduction.

The muscles are considered as contributing to the form and contour of the body, giving the inequalities to its surface, by the prominences of their fleshy bellies and the depressions between them. Nor are they less important, as forming the beds for the reception of the vessels and nerves, and thus while they point out the course of the vessels, assisting in the ready discovery of these: nor can we overlook their influence on the bones and joints, in preventing pain, deformity, and failure in the treatment of fractures and dislocations. It becomes therefore a point of high practical importance that their situation, attachments, and relative position should be mastered.

Nor does the anatomical examination of the organs situated within the large cavities of the body require a less particular attention, as they may have injury communicated to them, or may be the subject of disease, which must be often determined in a great measure from situation alone. Their appearance should be observed, and its shades of difference discriminated, that health and disease may be recognized under every form.

But above all others, perhaps, whether for the purposes of the general practitioner, especially in midwifery, or the more immediate functions of the surgeon, do the organs of generation, both in the male and female, demand attention: they are extensively connected with diseases, the treatment of which involves a variety of operations, from the simplest to the most complicated; but all requiring an intimate knowledge of their structure and relative position, and all intimately concerning the health and safety of the patient.

We have omitted no opportunity of attracting the attention to relative position. But important as this is in all parts, it is of especial importance in dissecting the arteries. In the following work, therefore, we have enumerated the parts in the neighbourhood of which they take their course, and shown their situation with respect to these parts. Thus the student will be enabled to notice where compression may be easily employed; to seek the points where they run over bone, where deeply embedded betwixt muscles, or where they are superficially placed. He will likewise attend to their chief anastomoses, so that he may duly estimate the power of preserving life in a part, by their enlargement, when the principal trunk supplying it has become obliterated. The importance of familiarizing the mind and eye with their situation in the planning and executing of operations, and the utility of a previous acquaintance with the accidents to which they are liable, together with the ready way of detecting them, must be obvious: for, without a previous knowledge of the exact position of the arteries, the obscurity occasioned by the hæmorrhage at the time of their injury, renders their discovery doubly perplexing. It scarcely need be added, that the larger branches are those which particularly claim attention; for, however by the dissection of the minute ramifications, the industry of the student may be displayed, or by learning their names by rote, he may astonish those who delight rather in the semblance than the reality of knowledge; yet, beyond their contingent advantages in aiding the acquirement of decision and dexterity in operation, they are rather to be deprecated than recommended.

Less obvious, but scarcely less important, is the claim which the Nerves have on the student's attention, not only that they may be preserved from injury, and avoided by the knife; but likewise because, by examining their distribution, we gain more accurate notions of disease, of the possible relations between distant parts, and the general harmony of the animal œconomy.

These, therefore, are the parts which have been investigated in the present work as systems, or traced throughout the body:—they are the elements, as it were, of anatomical knowledge. But, these being known, another mode of inquiry presents itself, that of examining the blending and interlacement of these parts together, as they are entering into the composition of the different portions of the body. It is from understanding this grouping of parts, that we are enabled to plan and foresee all the steps of an operation, or note the reasons why it may not be undertaken; whereas, without this investigation of them as a whole, our acquaintance with the individual and insulated systems can neither give us confidence, nor the knowledge essential to the practice of surgery.

We recommend the student to gain a perfect knowledge of the Bones; and then, in prosecuting dissection, to pursue the order laid down in this work. At the same time he must bear in mind, that, in some instances, the descriptions are more minute than the importance of the subject demands, from the Author's wish to make the work more complete for reference; but with the general directions already given, we presume, that the details will not abstract the attention from the leading points.

We should also advise the student to provide himself with some preparations, for the purpose of keeping up his anatomical knowledge. They should consist, at least, of a set of separate bones; and, if possible, of a skeleton; of an upper and a lower extremity, and of a head and neck, in the adult, injected to shew the blood-vessels; side-views of the male and female pelvis wet, —to shew, besides the relative position of the contents of the pelvis, the parts of inguinal and crural hernia. To these may be added a small subject, to shew the distribution of the nerves, and preparations of particular parts, as of the lacrymal sac and duct, &c. These consulted as occasion may require, with the help of a work of anatomical reference, may keep up a competent knowledge of anatomy.

These, then, are the uses of anatomical knowledge as acquired by dissection. In whatever age or country, the knowledge of Anatomy has been absent, medical science has existed in one or other of two extremes: it has either groped in detail with a blind empiricism, or blundered by wholesale with a dreaming and presumptuous arrogance; in the one case, sinking below experience —in the other, soaring above it, into the empty regions of abstraction. That *we* are enabled to take the middle path, we owe to the courage and industry of the great anatomists before us, more than to any other single cause. But there is one use to be derived from the study as at present pursued, which is negative indeed, but of scarcely less importance to the students as men, than the other and positive uses are to them as medical practitioners. By serious reflection on what Anatomy has not taught us, and what no Anatomy ever can teach us, the great laws of life, we learn not to over-value the senses so as to forget the higher faculties of our nature, at the very time that we are most sensible that it is only by combining these with the exercise of the senses, that we can exert ourselves to any purposes of utility or of duty in that world of the senses which is the appointed sphere of both.

THE DISSECTOR'S MANUAL.

Section the First,

CONTAINING THE

DISSECTION OF THE MUSCLES AND JOINTS OF THE EXTREMITIES.

ROYAL ARMY MEDICAL COLLEGE
No.
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THE
DISSECTOR'S MANUAL.

SECTION THE FIRST

CONTAINING THE DISSECTION OF THE

MUSCLES AND JOINTS OF THE EXTREMITIES.

CHAPTER I.

Terms. Preparatory Notices.

In describing *relative position,* the anatomist supposes the body erect, with the arms in such a position that the palms of the hands are turned forwards, and the lower extremities so placed that the knees and toes shall be directly in front. The terms, by which relative position is usually denoted, with their several senses, are as follow. By *superior* and *inferior,* we signify higher and lower with respect to *the summit of the head*; by *anterior* and *posterior,* we denote the situation of the parts as nearer to the fore or the hinder surface of the body; and by *laterally* to the *right* or *left,* we understand that the parts so described approach the one side or the other. *Inner* and *outer* express the relation of any given part or portion of the body to an imaginary plane, assumed by anatomists for the purpose of distinct conception or description, and named by them the *Mediàn* plane, it being supposed to bisect the body into lateral halves, passing through the middle of the head and trunk, and continued between the inferior extremities: *inner* denotes an approach to, *outer* a removal from, this imaginary plane. The terms *external* and *internal, without* and *within,* are used only in speaking of cavities.

The present Work is divided into four Sections. The first contains the dissection of the muscles and joints of the extremities. The second comprises the dissection of the head, neck, chest, abdomen, and pelvis. The third gives the dissection of the vessels and nerves. Lastly, the fourth section considers the organs of the senses, and of the voice, and directs the attention of the student to those parts, the knowledge of which is more especially required in surgical practice. The parts are arranged in the order of dissection, and annexed to the descriptions there is given a brief reference to those morbid appearances that are most likely to occur, and which it is always advisable to look for.

In the description of the muscles, we have adopted the plan of distributing them into regions, in the belief that no other plan affords equal facilities in acquiring distinct conceptions, and in promoting a ready recollection, of the organs and their situation. Their position and extent deserve particular attention; not so much as regarding the muscles themselves, as in connexion with the relative position of more important parts.

We shall now conclude this brief explanatory chapter with a few practical directions, that may be of use to a student anxious to commence his anatomical studies with the best advantage, under the head of

PREPARATORY NOTICES.

In the dissection of the muscles, a knowledge of their boundaries, attachments, and actions, ought to be gained; and as they are especially fitted, and here are chosen, to initiate the student in the practical part of anatomy, dexterity in the use of the knife ought to be attained.

The only instrument which for the most part will be found necessary is the knife; and, as skill in its use is essentially requisite in surgical operations, it ought to be preferred wherever it is found not absolutely inconvenient. The scissars are not required in the dissection of the muscles, and seldom in that of other parts; and the fingers should be used instead of the forceps, both because they are better instruments, and because the free use of them cannot be too soon acquired.

For the easy and compleat dissection of a muscle, it should be first put upon the stretch, that is, its points of attachment should be separated from each other till it is rendered tense. Besides the necessity of so doing in order to clean it, there is an advantage gained in learning how to extend a muscle, as it points out in what direction its action will be exerted in order to approximate the parts to which it is fixed. In the next place, a clean cut should be made through the coverings of the muscle, whether of skin or fascia, down to the muscular fibre; and the incision should be carried in the course of the fibres of the muscle, and, if possible, from one extremity to the other. The skin or other covering is then to be taken between the fingers and thumb, and drawn from the surface of the muscle, so as to stretch the cellular membrane which connects them, and the edge of the knife is to be carried through this reticular texture, in the course of the fibres, from one end of the muscle to the other; and this is to be repeated with each bundle of fibres, and, if possible, from right to left, until the boundaries of the muscle are displayed.

The muscles are introduced in the order in which it will be found most convenient to dissect them.

CHAPTER II.

Of the Muscles of the Upper Extremity.

The muscles of the upper extremity are distributed into regions, on the Trunk, Arm, Fore-Arm, and Hand.

§ 1. ON THE TRUNK.

a. Anterior Thoracic, containing the

1. **Pectoralis Major.** Covering the fore and upper part of the chest. Broad: irregularly triangular.

Origin. By short tendinous fibres from the sternal half of the clavicle, commonly called its clavicular portion; from nearly the whole length of the upper and middle bones of the sternum, called its sternal portion; and from the cartilages of the fifth and sixth ribs. One slip is frequently joined with the external oblique muscle of the abdomen. Between the sternal and clavicular portions, there is frequently a distinct separation. The fibres extend and converge towards the axilla, opposite to which they have a folded appearance.

Insertion. By a strong tendon, which crosses the tendon of the long head of the biceps muscle, into the outer ridge of the groove, for lodging that portion of the biceps.

2. **Pectoralis Minor.** Is displayed by dissecting back the former muscle. It is less than that muscle, and of a triangular figure.

Origin. Tendinous and fleshy, by three, or sometimes four, heads from the third, fourth, and fifth ribs, (more rarely from the sixth) near their cartilages. The fibres pass obliquely outwards, and are collected into a short tendon.

Insertion. Into the point of the coracoid process of the scapula.

3. SUBCLAVIUS. Situated under the clavicle.

Origin. Tendinous from the cartilage of the first rib. It becomes fleshy, and passes upward and outward under the clavicle.

Insertion. Into the under surface of the clavicle from near its sternal extremity to a point opposite to the coracoid process of the scapula.

b. LATERAL THORACIC, containing the

1. SERRATUS MAGNUS (serratus major anticus). Broad, thin, irregularly triangular, covers the greater part of the sides of the eight upper ribs.

Origin. By fleshy digitations from the nine uppermost ribs. Its fibres are directed backward, with different degrees of obliquity.

Insertion. Fleshy into the whole length of the base of the scapula, between the attachments of the rhomboid and subscapular muscles, and especially about the inferior angle of the scapula.

c. DORSO-LUMBAR, containing the

1. TRAPEZIUS. Is so named from its figure. It is broad and thin.

Origin. From the protuberance and arched ridge of the os occipitis: from the ligamentum nuchæ, by which it is connected to the opposite muscle: from the spinous processes of the two undermost cervical vertebræ, and from all those of the back, except sometimes the two or three lowest, by short tendinous fibres, which connect it with the opposite muscle of the same name. Its fibres pass obliquely in different directions toward the scapula.

Insertion. Fleshy into the upper and outer part of the clavicle; tendinous and fleshy into the acromion and spine of the scapula.

2. LATISSIMUS DORSI. It is of a triangular figure: it covers the lower part of the back and the whole of the lumbar region.

Origin. By a broad thin tendon from the spinous processes of the seven inferior vertebræ of the back, sometimes from not more than four; from the spinous processes of all the vertebræ of the loins; from the spinous and oblique processes of the sacrum; from the outer labium of the posterior part of the spine 3rd of the ilium, and by tendinous and fleshy slips from the three or four inferior ribs. The superior fibres pass nearly transversely, the inferior run with different degrees of obliquity towards the axilla. Near the inferior angle of the scapula, the fibres are collected, and have a folded appearance, and frequently receive an additional slip from that part.

Insertion. By a strong flat tendon into the inner edge of the groove for lodging the tendon of the long head of the biceps.

d. DORSO-CERVICAL, containing the

1. LEVATOR SCAPULÆ (levator anguli scapulæ: musc. patientiæ.) Situated at the posterior and lateral part of the neck.

Origin. By tendinous and fleshy slips from the transverse processes of the five uppermost cervical vertebræ, frequently from four, sometimes from three or two only. These slips unite to form a rounded muscle, which passes outward and downward.

Insertion. Tendinous and fleshy into the superior angle of the scapula.

2. RHOMBOIDEUS MAJOR. This and the following muscle are named from their figure, and are situated between the scapula and spine.

Origin. Tendinous from the spinous processes of the five superior vertebræ of the back; its fibres pass with a slight obliquity outwards.

Insertion. Into that part of the base of the scapula which is below the spine.

3. RHOMBOIDEUS MINOR, situated immediately above the former, and is sometimes not separated from it.

Origin. Tendinous from the spinous processes of the three, or sometimes two, inferior cervical vertebræ, and ligamentum nuchæ.

Insertion. Into that part of the base of the scapula which is above the spine.

§ 2. ON THE SHOULDER.

a. EXTERNAL SCAPULAR, containing the

1. DELTOIDES. A strong fleshy muscle of a triangular figure, which covers the shoulder-joint, and gives roundness to the shoulder.

Origin. Tendinous and fleshy from the scapular extremity of the clavicle, and from the acromion process of the scapula: and tendinous from the edge of the whole of the spine of the scapula. The fibres converge as they descend and form strong bundles, which are intermixed with tendon.

Insertion. Tendinous below the pectoralis major, into a rough eminence on the outer side of the os humeri, near its middle.

Under the upper part of this muscle, between it and the capsule of the shoulder-joint, is a considerable *bursa mucosa,* which commonly extends forward under the acromion. It is sometimes double.

b. POSTERIOR SCAPULAR, containing the

1. SUPRA-SPINATUS. Occupies the fossa supra-spinata.

Origin. Fleshy from the whole of the fossa supra-spinata, from the upper part of the spine, from that part of the base which is above the spine, and from the superior costa of the scapula. It passes under the acromion, forms a strong tendon, which passes over the capsule of the joint, and thereby strengthens it.

Insertion. Into the upper and inner part of the larger tubercle of the os humeri.

2. INFRA-SPINATUS. Is of a triangular figure, and occupies the fossa infra-spinata. This, and the above described muscle, are covered by a strong aponeurosis, to which many of their fleshy fibres are attached.

Origin. Fleshy, from the dorsum below the spine, from the under surface of the spine, and from that part of the base of the scapula which is below the spine. The fibres pass obliquely towards a middle tendon, which passes forward, and adheres to the capsular ligament.

Insertion. By the above thick and short tendon into the middle part of the larger protuberance on the head of the os humeri.

Under the tendon of this muscle, between it and the scapula, is a considerable *bursa mucosa.*

3. TERES MINOR. Is a small oblong muscle, which lies under, and is often not distinctly separated from the former.

Origin. Fleshy from the middle, and rounded part of the inferior costa of the scapula. It runs forward under the infra-spinatus, and adheres to the capsular ligament.

Insertion. By a strong short tendon into the under and back part of the greater protuberance on the head of the os humeri.

4. **Teres Major.** Is situated below the former muscle: it has the same figure, but is of larger size.

Origin. Fleshy from the inferior angle of the scapula, the dorsum near to it, and from a part of the inferior costa. It adheres to the teres minor and infra-spinatus, then passes obliquely downwards and forwards.

Insertion. By a broad, short, and thin tendon, with the latissimus dorsi, into the inner edge of the groove for lodging the tendon of the long head of the biceps muscle.

Between the tendon of this muscle, that of the latissimus dorsi, and the bone, is placed a small *bursa mucosa.*

c. **Anterior Scapular,** containing the

1. **Subscapularis.** Is a muscle of large size, and fills completely the venter of the scapula.

Origin. Fleshy from the whole of the internal surface, which is marked by its fleshy bundles, from all the base of the scapula internally, and from its superior and inferior costæ. The fasciculi, of which the muscle is composed, run with different degrees of obliquity, and are attached to tendinous intersections. They pass outwards, and converge.

Insertion. Into the upper part of the less protuberance on the head of the os humeri, by a short, flat, and thick tendon, which adheres to the capsular ligament, and like the tendons of the teres major and minor, and of the supra-spinatus, contributes to give strength to the joint.

There are two *bursæ* connected with this muscle. The more considerable is situated at the neck of the scapula and root of the coracoid process, and is sometimes connected with the capsule of the shoulder joint: the smaller is placed more anteriorly between the capsular ligament and tendon of the muscle, but is not always found.

§ 3. APONEUROSIS OF THE UPPER EXTREMITY.

It is not necessary to dissect this tendinous expansion throughout its extent, but its different parts may be attended to during the dissection of the regions, to which it forms a covering.

The muscles of the upper extremity are covered by a tendinous expansion, or aponeurosis (fascia brachialis). It may be traced in muscular subjects from the deltoid muscle, and then extends over the exterior of the muscles of the upper arm; but is stronger on the posterior than on the anterior part. At the lower part a layer extends inwards from it on each side, which is connected to the ridges and condyles of the os humeri, called the *inner* and *outer intermuscular ligaments.* Situated between the flexors and extensors, they increase the surface of their attachment.

At the bend of the elbow the fascia brachialis is strengthened by cross fibres, and receives additions from the tendon of the triceps and biceps. It extends over the fore arm, and forms a thicker and stronger covering to the muscles than on the upper arm, and gives off partitions which extend between the muscles, and are attached to the radius and ulna. Towards the lower extremity of the fore-arm, on the fore part, it becomes gradually thinner; but on the posterior part of the fore-arm and carpus, it is thickened and strengthened by transverse fibres, which form here the *posterior transverse ligament of the wrist* (ligamentum carpi dorsale, annulare posterius). This ligament is attached to the radius, ulna, os pisiforme, and metacarpal bone of the little finger, and binds down the tendons of the extensor muscles.

§ 4. ON THE ARM.

a. ANTERIOR BRACHIAL, containing the

1. CORACO-BRACHIALIS. Situated on the inner side, and perforated by the musculo-cutaneous nerve.

Origin. Tendinous from the fore part of the coracoid process of the scapula, in common with the short head of the biceps muscle, with which it is connected through a great part of its length.

Insertion. Tendinous and fleshy into the inner part of the os humeri, near its middle. It is sometimes continued into the brachialis internus.

An imperfect *bursa* is formed between its tendon above, and that of the biceps and capsular ligament of the shoulder joint.

2. BICEPS FLEXOR CUBITI. Is a long muscle, which extends along the whole of the fore part of the humerus. It consists of two heads, a longer and a shorter, which remain separated for some way, and are afterwards united.

Origin. The *long head* (caput longum) situated on the outer side, arises by a slender tendon from the upper edge of the glenoid cavity of the scapula, passes over the head of the os humeri within the joint, and descends exterior to the capsule in the groove between the tubercles, surrounded by a tendinous sheath, derived from the capsular ligament. The *short head* (caput breve) arises tendinous and fleshy from the coracoid process of the scapula, in common with the coraco-brachialis muscle. The two heads are united a little below the middle of the fore part of the os humeri, and form a muscle of which the outline is distinct when covered by the integuments.

Insertion. By a strong roundish tendon into the inner side of the tubercle of the radius.

Along the inner side of this muscle are passing the principal vessels of the extremity. These are placed on the anterior part of the arm, to the inner side of the biceps muscle, as far as the bend of the elbow: at this part a division takes place, and during the greater part of the rest of their course, they become situated on either side of the fore-arm, in the region of the radius and ulna.

A considerable *bursa* is situated between the lower tendon of this muscle and the tubercle of the radius.

3. BRACHIALIS INTERNUS. Covers the anterior and inner surface of the under half of the os humeri.

Origin. Fleshy, from about the middle of the os humeri by two attachments, which extend above the insertion of the deltoid muscle on each side. It forms a strong muscle, which passes over the fore part of the capsule of the elbow joint, to which it firmly adheres.

Insertion. By a strong short tendon into the coronoid process of the ulna.

A *bursa* is sometimes found between the tendon of this muscle, that of the biceps and capsule of the joint.

b. POSTERIOR BRACHIAL, containing the

1. TRICEPS EXTENSOR CUBITI. Covers the whole of the back part of the os humeri, and reaches from the scapula to the elbow.

Origin. By three heads. The *long head* (caput longum) arises by a short thick tendon, from the inferior costa of the scapula, immediately before the attachment of the teres minor. The *short head* (caput breve) arises by an acute tendinous and fleshy beginning from the outer and back part of the os humeri just below the head. The third head is called the *brachialis externus*: it arises by an acute beginning from the back part of the os humeri, near the insertion of the teres major. The three heads unite about the middle of the humerus, but continue to adhere to the whole of the posterior surface of the bone, and to the condyles.

Insertion. By a broad thick and strong tendon into the upper and outer part of the olecranon of the ulna.

Between this tendon and the olecranon is situated a considerable *bursa*; and sometimes one or two smaller ones.

§ 5. ON THE FORE-ARM.

a. **ANTERIOR SUPERFICIAL**, containing the

1. **PALMARIS LONGUS.** This muscle is not unfrequently wanting, and is subject to varieties of form.

Origin. Tendinous from the inner condyle of the os humeri. It soon becomes fleshy, and about the middle of the fore-arm sends off a slender flat tendon, which runs very superficially.

Insertion. Into the ligamentum carpi annulare, and aponeurosis palmaris.

This *aponeurosis palmaris* should now be displayed; but first the palmaris brevis, a small muscle on the inner side of the hand, must be dissected. The

PALMARIS BREVIS consists of small transverse fibres, which arise from the ligamentum carpi annulare and aponeurosis palmaris, are inserted into the os pisiforme, and are lost in the skin and cellular membrane which cover the abductor minimi digiti.

The *aponeurosis palmaris* covers the palm of th ehand; it is of a triangular figure, and spreads from the annular ligament to the fingers, but becomes gradually thinner before and at the sides. It seems to be formed in most instances by the spreading out of the fibres of the tendon of the palmaris longus, with the addition of some transverse fibres; but this is not always the case, for although the palmaris longus is not unfrequently wanting, the aponeurosis is always found.

The other muscles in the anterior superficial region of the fore-arm, the dissection of which is now to be prosecuted, are:

2. **PRONATOR TERES.**

Origin. Tendinous and fleshy, from the inner condyle of the os humeri, and tendinous from the coronoid process of the ulna, passes obliquely downward and outward.

Insertion. Tendinous and fleshy into the outer and back part of the radius near its middle.

3. **FLEXOR CARPI RADIALIS** (radialis internus).

Origin. Tendinous and fleshy from the inner condyle of the os humeri, and from the fore and upper part of the ulna, where it adheres at the sides to the flexor sublimis and pronator teres. It passes downward, terminates about the middle of the fore-arm in a long flat tendon, which passes behind the ligamentum carpi annulare, and through the fossa of the os trapezium.

Insertion. By a flat tendon into the fore and upper part of the metacarpal bone, which sustains the fore-finger.

Between the tendon of this muscle, the os trapezium, and the ligamentum carpi, is situated a *bursa.*

4. FLEXOR CARPI ULNARIS.

Origin. Tendinous from the inner condyle of the os humeri, and fleshy from the inner side of the olecranon of the ulna. It passes along the inner side of the ulna, to which it adheres above. It receives also additional fibres from the aponeurosis of the fore-arm.

Insertion. By a short strong tendon into the os pisiforme.

Between the tendon of this muscle and the os pisiforme a *bursa* is found.

5. FLEXOR DIGITORUM COMMUNIS SUBLIMIS (perforatus).

Origin. Deeper seated than the former muscles, by a tendinous and fleshy head, from the inner condyle of the os humeri, and adheres to the capsule of the joint; likewise tendinous from the inner edge of the coronoid process of the ulna, and from the fore part of the radius near the extremity of the supinator brevis. Near the middle of the fore-arm it is divided into four fleshy bellies, which each send off a slender tendon. The tendons pass under the ligament of the wrist to the fingers.

Insertion. Into the bones which form the second phalanx in each of the fingers, near their extremity, after being divided near the middle of the bones of the first phalanx, to form a passage for the tendons of the flexor profundus.

After having removed the integuments from the fore part of the fore-arm, the above muscles are the first which come into view.

b. ANTERIOR DEEP, containing the

1. FLEXOR DIGITORUM COMMUNIS PROFUNDUS (perforans) is more considerable than the former muscle, and is situated immediately behind it.

Origin. From the upper two-thirds of the outer side of the ulna, and from a considerable portion of the interosseous ligament. It divides into four fleshy bellies, and these terminate in an equal number of tendons, which pass behind the ligament of the wrist, and through the divisions of the tendons of the former muscle.

Insertion. Into the fore and upper part of the bones, which form the third phalanx.

It is better to trace the tendons of the two above described muscles to their insertion, by raising the aponeurosis palmaris, and at the same time to dissect the lumbricales, although these parts are situated in the palm of the hand, and on the fingers, the examination of the other parts of which is to be deferred. It will be the fittest opportunity likewise to display the ligaments and sheaths connected with the tendons of these muscles. The

LUMBRICALES are four small muscles, so named from a supposed resemblance to earth-worms, which are situated close to the tendons of the flexor muscles in the palm of the hand.

Origin. From the outer side of the tendons of the flexor profundus, a little above the lower edge of the annular ligament.

Insertion. By slender tendons, which spread on the outer side of the bones of the first phalanx.

§ 6. LIGAMENTS AND SHEATHS OF THE FLEXOR-MUSCLES.

ANTERIOR ANNULAR, or TRANSVERSE LIGAMENT (ligamentum annulare vel transversum carpi), consists of transverse and oblique fibres, forming a strong band, which is stretched across between the projecting points of the os pisiforme and os unciforme to the os scaphoides and os trapezium. The tendons of the flexor muscles of the fingers, and the tendon of the flexor radialis in a sheath of its own, pass behind it.

Behind this ligament is a *bursa*, which begins above the wrist joint, and extends to the metacarpus. It incloses the tendons of both flexors, and sends off processes which surround and loosely connect them.

On the fingers VAGINAL LIGAMENTS are found, which consist of transverse, oblique, and decussating fibres, which run over the tendons of the flexors, and are fixed to the edges of the bones of the phalanges. Upon the body of these bones they are thick and strong, but over the joints they are thin, and become weaker towards the extremities of the fingers. On the joints they are frequently called the *annular ligaments* (annuli juncturarum ligamentosi), and the fasciculi between the crucial ligaments of the first and second phalanx (annuli cruciati phalangis primæ et secundæ).

These ligamentous sheaths are lined by SYNOVIAL MEMBRANES, which begin a little above the first joint, and extend to the middle of the third phalanx, and form a lubricated surface for the motion of the tendons of the flexors which are contained within them. The tendons are unconnected except by small tendinous processes called the *accessory ligaments of the flexor tendons*, which arise from the first and second phalanges, run obliquely forwards within the sheaths, and terminate in the tendons of the two flexor muscles.

The dissection of the other muscles in the anterior deep region of the fore-arm is now to be prosecuted. They consist, besides the flexor profundus digitorum, of the

2. FLEXOR POLLICIS LONGUS.

Origin. Fleshy from the fore part of the radius, its attachment extending from the tubercle of the bone to the insertion of the pronator quadratus, and from the interosseous ligament. It has generally another origin by a separate slip from the inner condyle of the os humeri, or from the coronoid process of the ulna. It sends out a strong tendon, which passes with the tendons of the former muscles into the hand, and runs between the heads of the flexor brevis.

Insertion. Into the second bone of the thumb. Its tendon is inclosed in a peculiar synovial bursa.

3. PRONATOR QUADRATUS. Is so named from its figure. It is situated on the lower extremities of the radius and ulna.

Origin. Broad, tendinous and fleshy, from the inner and fore part of the lower portion of the ulna. Its fibres pass transversely.

Insertion. Into fore and outer part of the opposite portion of the radius.

c. POSTERIOR SUPERFICIAL, containing the

1. ANCONEUS. Of a triangular figure. It is concealed by a strong aponeurosis.

Origin. Tendinous from the posterior part of the outer condyle of the os humeri. It passes downward and inward, and spreads in its descent. The upper edge is commonly connected with the triceps.

Insertion. Broad and fleshy into the ridge on the outer and back part of the ulna, below the olecranon.

2. EXTENSOR COMMUNIS DIGITORUM.

Origin. Tendinous and fleshy from the outer condyle of the os humeri, where it adheres to the supinator brevis. About the middle of the arm it divides into four fleshy bellies, which terminate in an equal number of long flattened tendons. These pass under the dorsal ligament of the wrists upon the back of the hand, where they become broader and thinner, and are connected by oblique tendinous bands.

Insertion. Into the back part of the bones of the phalanges of the four fingers by a tendinous expansion.

There is frequently a separate slip, called extensor digiti minimi proprius, which arises from the ulna, and passes to the little finger.

A *bursa* is situated at the wrist for the tendon of this muscle, which sends out a synovial sheath with each of the tendons, as far as the roots of the fingers.

3. EXTENSOR CARPI ULNARIS.

Origin. Tendinous from the outer condyle of the os humeri, which descends along the outer surface of the ulna, and receives from it additional fibres. It terminates in a strong tendon, which passes under the dorsal ligament of the wrist, and over the hand.

Insertion. Into the upper and back part of the metacarpal bone which supports the little finger.

d. POSTERIOR DEEP, containing the

1. EXTENSOR OSSIS METACARPI POLLICIS (abductor pollicis longus).

Origin. Fleshy from the upper part of the ulna, from the interosseous ligament, and from the middle of the outer surface of the radius. It passes over the radius, and terminates in a strong tendon, which passes through a separate partition of the annular ligament, and commonly separates into two or three slips.

Insertion. Into the os trapezium, and upper and back part of the metacarpal bone of the thumb.

The tendon of this muscle is surrounded by a *sheath* of synovial membrane.

2. EXTENSOR PRIMI INTERNODII POLLICIS (extensor brevis, minor).

Origin. Fleshy from the back part of the ulna, and from the interosseous ligament, and descends connected with the former muscle. It terminates in a slender tendon, which passes under the dorsal ligament of the wrist with the former.

Insertion. Into the extremity of the first bone of the thumb, and a part may be traced as far as the second bone.

3. EXTENSOR SECUNDI INTERNODII POLLICIS (extensor major, longus).

Origin. Tendinous and fleshy from the back part of the ulna, and from the interosseous ligament. It sends out a long tendon, which passes down behind the radius, and under the dorsal ligament of the wrist, but separately from the tendons of the two muscles last-mentioned.

Insertion. Into the second bone of the thumb. Its tendon runs in a synovial *bursa* or sheath.

4. INDICATOR.

Origin. Fleshy immediately below the former muscle, from the middle of the back part of the ulna. Its tendon passes under the dorsal ligament, with those of the extensor digitorum communis.

Insertion. Into the back part of the fore-finger, in common with the tendon of the extensor digitorum communis.

c. RADIAL, containing the

1. SUPINATOR RADII LONGUS.

Origin. Fleshy from the ridge on the os humeri, which extends above the outer condyle, and begins in a sharp point as high as the middle of the bone. It covers the extensor carpi radialis longior, and descends on the outer side of the arm. Above the middle of the fore-arm it terminates in a slender flat tendon.

Insertion. Into the outer side of the base of the radius.

2. EXTENSOR CARPI RADIALIS LONGIOR.

Situated immediately under the former muscle.

Origin. Broad and fleshy from the ridge above the outer condyle of the os humeri, below the supinator longus, as far as the outer condyle. It forms a thick fleshy belly, which passes over the outer condyle, and descends along the radius. It sends off a long flat tendon, which takes at first the same direction, then passes, in an appropriate groove, over the back part of the radius, under the annular ligament.

Insertion. Into the upper and back part of the metacarpal bone, which supports the fore-finger.

The tendon of this muscle, at the extremity of the radius, is surrounded by a synovial *sheath*, and there is a small *bursa* between its attachment and the metacarpal bone.

3. EXTENSOR CARPI RADIALIS BREVIOR.

Resembles the former, and is situated beneath it.

Origin. Tendinous from the outer condyle of the os humeri, and from the ligament which passes from it to the radius. It descends along the radius, and terminates below the former in a flat tendon, which passes upon the back part of the radius, and under the annular ligament, with the tendon of the extensor longior.

Insertion. Into the upper and back part of the metacarpal bone of the middle finger.

Between the bone and its insertion is situated a small *bursa.* The tendons of both the above described muscles are surrounded by synovial *sheaths.*

4. SUPINATOR RADII BREVIS. Is the deepest seated of the muscles in this region.

Origin. Tendinous without, and fleshy within, from the outer condyle of the os humeri, and from the outer and upper part of the ulna, and adheres to the capsule of the joint. Its fibres pass obliquely downwards and forwards over the upper part of the radius.

Insertion. Into the upper part of the fore and inner surface of the radius, and surrounds the head, neck, and tubercle of that bone.

§ 7. ON THE HAND.

a. MIDDLE PALMAR, containing the aponeurosis palmaris, lumbricales, and the tendons of the flexors of the fingers, has been already described.

b. OUTER PALMAR, containing the

1. FLEXOR BREVIS POLLICIS (Anthenar).

Origin. From the os trapezoides, os magnum, and os unciforme of the carpus. It is formed of two fleshy bellies, between which the tendon of the flexor longus pollicis passes.

Insertion. Into the ossa sesamoidea and first bone of the thumb.

2. FLEXOR OSSIS METACARPI POLLICIS (opponens pollicis). Situated under the abductor pollicis.

Origin. Tendinous and fleshy from the os trapezium and ligamentum carpi annulare.

Insertion. Tendinous and fleshy into the fore and outer part of the metacarpal bone of the thumb.

3. ABDUCTOR POLLICIS. Situated superficially on the outer side.

Origin. Tendinous and fleshy from the os trapezium and ligamentum carpi annulare.

Insertion. Tendinous into the outer side of the root of the first bone of the thumb.

4. **ADDUCTOR POLLICIS.** Is deep seated in the palm.

Origin. Fleshy from nearly the whole length of the metacarpal bone that supports the middle fingers. Its fibres converge so as to give a fan-like appearance to the muscle.

Insertion. Tendinous into the inner side of the root of the first bone of the thumb.

5. **ABDUCTOR INDICIS.**

Origin. From the os trapezium, and from the inner side of the base of the metacarpal bone of the thumb.

Insertion. Tendinous into the outer and back part of the root of the first bone of the fore finger.

c. **INNER PALMAR**, containing the muscles of the little finger.

1. **ABDUCTOR MINIMI DIGITI.**

Origin. From the os pisiforme and ligamentum carpi annulare.

Insertion. Tendinous into the inner side of the root of the first bone of the little finger.

2. **FLEXOR PROPRIUS MINIMI DIGITI.** Is covered by the former.

Origin. From the hook-like process of the os unciforme and adjacent part of the annular ligament.

Insertion. Tendinous into the inner part of the root of the first bone of this finger. This muscle is frequently wanting.

3. **ADDUCTOR MINIMI DIGITI.**

Origin. Fleshy from the edge of the hook-like process of the os unciforme, and from that part of the annular ligament near to it.

Insertion. Tendinous into the inner and anterior part of the metacarpal bone which supports this finger.

d. **INTEROSSEAL.**

Besides the muscles above described, there is a set of small muscles, which occupy the spaces between the metacarpal bones. These are called *interossei;* they arise from the sides of the metacarpal bones, and are inserted tendinous, partly into the first joints of the fingers, and partly intermixed with the tendinous expansions of the extensor digitorum communis. They are divided into the internal and external. The *Interossei interni,* three in number, arise with single heads, and are seen in the palm of the hand. The *Interossei externi,* four in number, have double heads, and are seen both in the palm and on the back of the hand. They may be arranged, each with the name by which it is usually designated, as follows:

INTEROSSEI INTERNI:

1. PRIOR INDICIS.

Origin. Tendinous and fleshy, from the upper and outer part of the metacarpal bone that sustains the fore-finger.

Insertion. Into the outside of that part of the tendinous expansion from the extensor digitorum communis, which covers the posterior part of the fore-finger.

2. POSTERIOR INDICIS.

Origin. Tendinous and fleshy, from the root and inner part of the metacarpal bone that sustains the fore-finger.

Insertion. Into the inner side of the tendinous expansion which is sent off from the extensor digitorum communis, along the posterior part of the fore-finger.

3. PRIOR ANNULARIS.

Origin. From the outer side of the root of the metacarpal bone that sustains the ring-finger.

Insertion. Into the outside of the tendinous expansion of the extensor digitorum communis which covers the ring-finger.

4. INTEROSSEUS AURICULARIS.

Origin. From the root and outer side of the metacarpal bone of the little finger.

Insertion. Into the outside of the tendinous expansion of the extensor digitorum communis, which covers the posterior part of the little finger.

INTEROSSEI EXTERNI SEU BICIPITES:

1. PRIOR MEDII.

Origin. Double from the roots of the metacarpal bones that sustain the fore and middle fingers. It runs along the outside of the middle finger.

Insertion. Into the outside of the tendinous expansion from the extensor digitorum communis, which covers the posterior part of the middle finger.

2. POSTERIOR MEDII.

Origin. Double from the roots of the metacarpal bones, that sustain the middle and ring-fingers.

Insertion. Into the inside of the tendinous expansion from the extensor digitorum communis, which runs along the posterior part of the middle finger.

3. POSTERIOR ANNULARIS.

Origin. Double from the roots of the metacarpal bones that sustain the ring and little fingers.

Insertion. Into the inside of the tendinous expansion of the extensor digitorum communis, which runs along the posterior part of the ring-finger.

§ 8. TABLE EXHIBITING THE ACTIONS OF THE MUSCLES OF THE UPPER EXTREMITY.

In studying the actions of muscles, it will be necessary to bear in mind that their points of attachment are reciprocally moveable upon each other, or may become, alternately, fixed points. But for obvious reasons we can in this place attempt no more than point out the mode in which the points of insertion are made to approach those of the origin of muscles. From this explanation, however, it will be easy to supply the manner in which, on the other hand, the points of origin may be moved upon the points of insertion, when the latter are the fixed points.

In the small space, which consistently with the plan and main purpose of this Manual, could be allotted to the actions of the muscles, it was necessary to confine our explanation to the mode, in which these actions produce the *direct* movements. It will not, therefore, be possible to explain the combined action of muscles, by which the various *intermediate* motions are produced, although it will not be difficult in any instance to understand, that if the muscles acting in different directions combine, they will produce a motion intermediate between both; that if for instance the muscles which raise the arm, should act at the same time as the muscles which carry it forwards, the motion produced will be that of carrying it upwards *and* forwards.

For the same reason it will be expedient to omit the successive action of muscles; as those for instance by which the direct and intermediate movements of the humerus are made to succeed each other in such a manner, that the point of the elbow shall describe a circle.

The muscles of the upper extremity perform the motions of the bones of the shoulder, of the os humeri, of the fore-arm, of the radius, of the hand, of the thumb, and fingers.

The MOTIONS OF THE CLAVICLE AND SCAPULA *together* are *upwards—downwards—forwards*, and *outward—backward* and *inward*. The scapula has besides a motion of *rotation*. The muscles performing these movements may therefore be divided into—*a*. ELEVATORS, *b*. DEPRESSORS, *c*. MOTORS FORWARD, *d*. MOTORS BACKWARD, and *e*. ROTATORS of the Scapula.

a. ELEVATORS.

1. Trapezius.
2. Levator scapulæ.

b. DEPRESSORS.

1. Serratus magnus.
2. Subclavius.
3. Pectoralis major.
4. Pectoralis minor.

c. MOTORS FORWARD.

1. Serratus magnus.
2. Pectoralis minor.
3. Pectoralis major (by moving the humerus).

d. MOTORS BACKWARD.

1. Rhomboideus major.
2. Rhomboideus minor.
3. Trapezius.
4. Latissimus dorsi (by moving the humerus). by [illegible]

e. ROTATORS OF THE SCAPULA (so as to raise the point of the shoulder).

1. Trapezius.
2. Serratus magnus.

THE MOTIONS OF THE HUMERUS are those of *Extension*, or carrying the humerus forward—*Flexion*, or carrying the humerus backward—*Abduction*, or carrying the humerus from the trunk, and raising it from the side—*Adduction*, bringing it towards the trunk—*Rotation*, which consists in turning the humerus upon its axis, either inwards or outwards. The muscles may be therefore divided into—*a*. EXTENSORS, *b*. FLEXORS, *c*. ABDUCTORS, *d*. ADDUCTORS, *e*. ROTATORS inward, *f*. ROTATORS outward.

a. EXTENSORS.

1. Deltoides (anterior portion of).
2. Subscapularis.
3. Coraco-brachialis.
4. Biceps.
5. Pectoralis.

b. FLEXORS.

1. Deltoides (posterior portion of).
2. Teres major.
3. Teres minor.
4. Triceps (long head of).
5. Latissimus dorsi.

c. ABDUCTORS.

1. Deltoides.
2. Supra-spinatus.
3. Infra-spinatus.
4. Subscapularis.

d. ADDUCTORS.

1. Pectoralis major.
2. Latissimus dorsi.
3. Teres major.

e. ROTATORS INWARD.

1. Subscapularis.
2. Deltoïdes (ant. portion of).
3. Latissimus dorsi.
4. Teres major.

f. ROTATORS OUTWARD.

1. Infra-spinatus.
2. Teres minor.
3. Deltoides (posterior portion of).

The MOTIONS OF THE RADIUS AND ULNA together upon the humerus are those of *flexion* and *extension.*—The muscles may, therefore, be divided into—*a.* FLEXORS, and *b.* EXTENSORS.

a. FLEXORS.

1. Biceps.
2. Brachialis internus, assisted by the supinator longus, pronator teres, and flexors of the hand, which arise from the os humeri.

b. EXTENSORS.

1. Triceps.
2. Anconeus.

The MOTIONS OF THE RADIUS upon the ulna, by which the palm of the hand is turned forwards, or made supine, and turned backwards, or rendered prone, are called *supination* and *pronation;* and the muscles concerned in these motions are, therefore, divided into—*a.* SUPINATORS, and *b.* PRONATORS.

a. SUPINATORS.

1. Biceps.
2. Supinator brevis.
3. Extensor ossis metacarpi pollicis.
4. Extensor primi internodii pollicis.
5. Supinator longus.

N. B.—This last muscle is perhaps not so properly named *Supinator;* as it appears rather calculated to bring the radius to a mid-state between pronation and supination, and, when in that state, to inflect it upon the humerus.

b. PRONATORS.

1. Pronator teres.

2. Pronator quadratus.
3. Flexor carpi radialis.

The MOTIONS OF THE HAND upon the fore-arm consist of inflexions forward or *flexion:* inflexion backwards, or *extension:* inflexions outward, or *abduction:* inflexions inward, or *adduction.* The muscles, therefore, may be divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor carpi radialis.
2. Flexor carpi ulnaris.
3. Palmaris longus.
4. Flexor digitorum sublimis.
5. Flexor digitorum profundus.
6. Flexor longus pollicis.

b. EXTENSORS.

1. Extensor carpi radialis longior.
2. Extensor carpi radialis brevior.
3. Extensor secundi internodii pollicis.
4. Indicator.
5. Extensor communis digitorum.

c. ABDUCTORS.

1. Extensor ossis metacarpi pollicis.
2. Extensor primi internodii pollicis.
3. Extensor carpi radialis longior.
4. Extensor carpi radialis brevior.
5. Flexor carpi radialis.

d. ADDUCTORS.

1. Extensor carpi ulnaris.
2. Extensor communis digitorum.
3. Flexor carpi ulnaris.
4. Flexor digitorum sublimis.
5. Flexor digitorum profundus.

The MOTIONS OF THE THUMB are those of *flexion*—*extension*—*abduction*—*adduction.* These muscles, therefore, are likewise divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor longus.
2. Flexor brevis.
3. Flexor ossis metacarpi.

b. EXTENSORS.

1. Extensor ossis metacarpi.
2. Extensor primi internodii.
3. Extensor secundi internodii.

c. ABDUCTORS.

1. Abductor pollicis.
2. Extensor ossis metacarpi.

d. ADDUCTORS.

1. Adductor pollicis.

The MOTIONS OF THE FINGERS, in like manner, are those of *flexion—extension—abduction—adduction*; and the muscles are therefore divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor digitorum sublimis.
2. Flexor digitorum profundus.
3. Lumbricales.
4. Flexor minimi digiti.

b. EXTENSORS.

1. Extensor communis digitorum.
2. Indicator (extensor of the fore-finger).

c. ABDUCTORS.

1. Abductor indicis.
2. Abductor minimi digiti.

3. Interossei:
    - Prior indicis.
    - Prior annularis.
    - Interosseus auricularis.
    - Prior medii digiti.

d. ADDUCTORS.

1. Adductor metacarpi minimi digiti.
2. Interossei:
    - Posterior indicis.
    - Posterior medii digiti.
    - Posterior annularis.

CHAPTER II.

Of the Joints of the Upper Extremity.

THE parts connected with the joints should be dissected after the muscles. If the soft parts surrounding them have become dry, it will be necessary to macerate them in water until the examination can be prosecuted with facility. As this Manual does not include a description of the bones, it will be of course necessary that a previous accurate knowledge of the extremities of bones, and of their mode of adaptation, should have been attained. During the examination it will be right not only to observe the number, strength, and disposition of the ligaments, but to pay attention also to the form and position of the cartilages and ligamento-cartilaginous substances connected with joints; so that by connecting together all the circumstances of structure, as they regard the bones, cartilages, and ligaments, a knowledge will be acquired of the mechanism, upon which the strength and the kind and extent of the motions in joints depend, and thus the mind may be led to contemplate the nature and treatment of the accidents to which they are liable. Consistently with the prescribed limits of this work, those circumstances only which regard structure can be explained; but an attention is recommended to the other and more practical points above stated, during the inspection of the parts. The joints of the upper extremity are,—1. Those of the bones of the shoulder, including that of the sternal extremity of the clavicle with the trunk, and that of the scapular extremity with the scapula. 2. Shoulder joint. 3. Elbow joint. 4. Those of the radius and ulna. 5. Wrist joint. 6. Joints of the hand.

§ 1. ARTICULATIONS OF THE BONES OF THE SHOULDER.

a. OF THE STERNAL EXTREMITY OF THE CLAVICLE. The sternal extremity of the clavicle is received into a depression of the uppermost bone of the sternum, with which it is connected; but it is attached also by ligament to the clavicle of the opposite side, and to the first rib. The parts which form the articulation are situated superficially, so that its situation, form, and motion, are in a great degree manifest before the integuments have been removed.

1. INTERCLAVICULAR LIGAMENT (ligamentum interclaviculare). Is formed of transverse fibres, and extends from the one clavicle to the opposite. It is attached to the upper bone of the sternum, above which it rises in the form of a thin edge. It connects, therefore, the two clavicles with each other, and with the sternum, and prevents the former from being carried too far backwards.

2. RHOMBOID LIGAMENT (ligamentum rhomboideum). Is named from its figure. It is attached above to the rough surface at the under and fore part of the clavicle, and is fixed below to the cartilage of the first rib. It fixes the clavicle, and moderates its motions.

3. The STERNO-CLAVICULAR ARTICULATION, is surrounded by ligamentous fibres, which are distinct, more especially on the anterior and posterior parts, and are attached to the bones about the articulating surfaces. Those before are the strongest; those behind, from their direction, have been called the *radiated* ligament.

4. INTERARTICULAR CARTILAGE. It is found between the articulating surfaces, and divides the joint into two cavities. It is thin in the centre, and thick at the circumference, being hollowed out in both surfaces.

5. SYNOVIAL MEMBRANES. There are two capsules formed by synovial membrane, which correspond to the divisions of this joint by the interarticular-cartilage.

b. OF THE SCAPULAR EXTREMITY OF THE CLAVICLE. The connexion of the clavicle to the acromion of the scapula is by means of a capsular ligament, and several accessory ligaments. This articulation, like the former, is situated so superficially, as to admit readily of examination beneath its common coverings.

1. CAPSULAR LIGAMENT. Is attached to the bones near the articular surfaces. It is short, and strengthened by strong transverse fibres on the exterior, more especially at the upper part.

Within this capsule is sometimes found a small *interarticular cartilage.*

There are besides two ligaments which pass from the clavicle to the coracoid process; they are intimately connected with each other, and are only distinguished by the different direction of their fibres, viz.

2. The **CONOID LIGAMENT** (ligamentum conoideum), which passes from the root of the coracoid process, and is fixed to a projection, called the tubercle, on the posterior edge of the clavicle.

3. The **TRAPEZOID LIGAMENT** (ligamentum Trapezoideum), which is situated exterior to the former. It extends from about the middle of the convexity of the coracoid process, passes more transversely, and is attached farther out to the under surface of the scapular extremity of the clavicle.

c. PROPER LIGAMENTS OF THE SCAPULA.

1. **ANTERIOR OR TRIANGULAR LIGAMENT** (ligamentum anterius triquetrum, coraco-acromiale). Is broad, flattened, and of a triangular figure. Its broad extremity is attached to the convexity of the coracoid process; it becomes gradually narrower, and is fixed to the posterior edge of the acromion. It is sometimes formed by two separate bundles united by a membranous substance. From its edge a layer of dense cellular membrane extends, under the deltoid muscle, and projects over the shoulder joint. It thus assists in preventing a displacement of the os humeri upwards.

2. **POSTERIOR LIGAMENT** (ligamentum scapulæ proprium posterius, minus). Is stretched across the semilunar notch, from the superior costa to the root of the coracoid process of the scapula, and forms that depression into a passage for the superior dorsal vessels and nerve of the scapula.

Besides these there is a band from the root of the acromion to the edge of the glenoid cavity, and another, which extends from the root of the coracoid process, and is also fixed to the lip of bone which bounds that cavity.

§ 2. OF THE SHOULDER JOINT.

The shoulder joint is surrounded by thick and strong muscles, which more especially contribute to give figure to this joint externally; of these the deltoid is the principal, which covers the articulation, and gives, in a muscular person, a well marked rotundity to the shoulder. From this circumstance, deformity in consequence of accident is not so easily detected, and the parts which form the articulation cannot be readily handled, so as to determine the nature and degree of any injury which may have occurred. The parts about the articulation, which may be felt when surrounded by the soft parts, are the acromion and, less distinctly, the coracoid process of the scapula, and the head of the os humeri.

1. CAPSULAR LIGAMENT. Is in the form of a loose bag, which is attached above to the circumference of the glenoid cavity, and below to the neck of the os humeri, and incloses the head of that bone. It is made up of fibres, closely interwoven with each other. It is strongest above, and thinnest on the inner side. It is strengthened above by the tendon of the supra-spinatus, and behind, by those of the infra-spinatus, and teres minor muscles. At the under and fore part, at its edge, is a small aperture for the passage of the tendon of the long head of the biceps, and the capsular ligament sends off a process to inclose the tendon in its descent.

2. SYNOVIAL MEMBRANE. It lines the capsular ligament, and is continued upon the articular surfaces of the scapula and os humeri. A process is extended into the groove for the tendon of the biceps, which is then reflected upwards round the tendon.

3. GLENOID LIGAMENT (ligamentum glenoideum). Is a projecting ring of ligamento-cartilaginous substance, which is attached to the circumference of the glenoid cavity, and thereby renders it deeper.

The tendon of the long head of the biceps answers somewhat the purpose of a ligament, in restraining the motions of the head of the os humeri, like the round ligament in the hip joint.

PRACTICAL POINTS. *Fractures* connected with this joint:—of the acromion—of the neck of the scapula—of the neck of the os humeri.

Dislocations:—Of the os humeri into the axilla—under the clavicle—on to the dorsum of the scapula.

§ 3. OF THE ELBOW JOINT.

The bones which enter into the composition of this joint, are the os humeri, the radius, and the ulna; and the parts of these bones connected with the joint are:—Of the os humeri, the two condyles, the double articular surface, and the anterior and posterior depressions: of the ulna, the olecranon, the coronoid process, and the sigmoid cavity: of the radius, the head. These articular surfaces are covered with cartilage.

The external form of the joint is determined in a great measure by the muscles which surround it, as the flexors of the fore-arm anteriorly, the flexors of the hand and fingers, the pronator below and before the inner condyle, the extensors of the hand and fingers, and the supinator about the outer condyle. These muscles conceal much of the articulation, and thereby often render the detection of the kind of injury, which may have occurred at this joint, difficult. The parts which may be felt are:—the olecranon, which is sub-cutaneous, and the inner condyle, and, less distinctly, the outer condyle between the extensors of the hand and fingers. The coronoid process is distinguished with difficulty in the depression at the upper part of the fore-arm, between the flexors and extensors.

1. INTERNAL LATERAL LIGAMENT (ligamentum cubiti laterale internum). Is fixed above to the fore part of the inner condyle of the os humeri, then descends spreading upon the inner side of the synovial capsule, and is attached below to the inner side of the coronoid process of the ulna.

2. EXTERNAL LATERAL LIGAMENT (ligamentum cubiti laterale externum). Resembles the former, and is stretched between the fore part of the outer condyle of the os humeri above, and the coronary ligament surrounding the neck of the radius below.

3. ANTERIOR AND POSTERIOR LIGAMENTS (ligamenta cubiti anterius et posterius). Are broader, but thinner than the lateral ligaments, and consist of fibres which are spread irregularly upon the fore and back parts of the capsule.

4. SYNOVIAL MEMBRANE. It extends from the articular surfaces of the os humeri; before from above the anterior depression, and behind from above the posterior depression, to the articular surfaces of the radius and ulna. The portion attached to the radius descends as far as the neck, so that the head is loosely surrounded by the synovial capsule. On the ulna it is extended to the greater and less sigmoid cavities. The synovial capsule is looser before and behind than at the sides. In the posterior depression of the os humeri, and at other parts of the joint, a quantity of fatty matter is found.

Practical Points. *Fractures:*—Of the condyles of the os humeri—of the olecranon.

Dislocations:—Of the radius and ulna forwards, or before the condyles of the os humeri—of the radius and ulna to the inner or outer side (partially)—of the radius and ulna backwards—of the radius only—of the extremity of the os humeri between the radius and ulna.

§ 4. ARTICULATIONS OF THE RADIUS AND ULNA.

The head of the radius is received into the less semilunar cavity of the ulna above; and the extremity of the ulna is received in a depression of the radius below. The surfaces in contact are covered by cartilage, so as to admit of motion, and ligaments are found at these parts for the purpose of moderating such motion. There is besides a broad ligamentous expansion filling up the space between the two bones.

1. **Coronary or Annular Ligament** (ligamentum radii annulare). Is extremely firm and strong, and is composed of transverse, circular fibres. It arises from the fore part of the small semilunar depression of the ulna, and after surrounding the neck of the radius, is fixed to the opposite extremity of that cavity. It is intermixed with fibres of the anterior and posterior, and of the external lateral ligaments above, but is terminated by an edge below.

2. **Oblique Ligament** (ligamentum cubiti obliquum, membrana transversa). Is attached above to the tubercle of the ulna. It extends obliquely downwards to the radius, and is fixed to the lower part of the tubercle of that bone.

3. **Interosseous Ligament.** Connects the radius and ulna through the greater part of their length, and is extended between the sharp ridges of these bones. It is broadest in the middle, and is composed of fibres, which run obliquely downwards and inwards. At different parts, there are openings for the passage of vessels; the most remarkable of which are above and below.

4. **Sacciform Capsule** (membrana capsularis sacciformis). The under extremity of the ulna is attached to the radius by a synovial capsule, which surrounds the articular surfaces of both bones, and is strengthened on the exterior by ligamentous fibres.

§ 5. OF THE WRIST-JOINT, OR ARTICULATION OF THE BONES OF THE FORE-ARM WITH THOSE OF THE CARPUS.

The bones, which are here articulated with each other, are the radius and ulna, with the three first bones of the upper row of the carpus, the scaphoides, lunare, and cuneiforme. They are connected by means of a capsule and accessory ligaments; but the extremity of the ulna does not form a part of the joint, owing to the intervention of an interarticular cartilage. The parts of this joint, being surrounded only by tendons, are superficial, and admit, therefore, readily of examination: the parts, which are the most prominent, are the styloid processes of the radius and ulna.

1. **Anterior and Posterior Ligaments** (ligamenta cubito-carpalia, palmare et dorsale). Are formed of strong fasciculi of oblique and perpendicular fibres. They are attached above to the margin of the articular surface of the radius, styloid process of the ulna, and interarticular cartilage, and are fixed below to the three first bones of the carpus.

2. **Inner lateral Ligament** (ligamentum cubitale). Is attached above to the styloid process of the ulna, is connected with the posterior ligament, and is fixed below to the posterior surface of the cuneiform, and to the pisiform bones.

3. **Outer lateral Ligament** (ligamentum radiale). Is attached above to the styloid process of the radius, and is fixed below to the scaphoid bone.

4. **Interarticular Cartilage.** It is placed between the extremity of the ulna and the cuneiform bone. It is firmly connected with the cartilage covering the end of the radius, and is loosely attached to the styloid process of the ulna. It is hollowed above and below. The synovial membrane of the wrist-joint is attached to its under surface, and the sacciform capsule to its upper surface; so that the extremity of the ulna and superior surface of the cartilage are excluded from the wrist-joint, but communicate with the articulation between the under extremities of the radius and ulna, and the proper joint of the wrist is therefore formed by the articular surface of the radius and the inferior surface of the interarticular cartilage above, and the articular surfaces of the scaphoid, the lunar, and the cuneiform bones below.

5. Synovial Membrane, or capsule of this joint. Is connected with the articular surfaces and lines the ligaments which surround the joint.

Practical Points.—*Dislocations* of the carpus:—backwards—forwards. *Amputation* at the wrist-joint.

§ 6. ARTICULATIONS OF THE HAND.

a. Articulations between the Carpal Bones.—The bones of the first and second row of the carpus are connected by ligaments, which resemble those of the wrist-joint.

1. An Anterior and Posterior Ligament. Are attached to the three first bones of the uppermost row, and are fixed below to the four bones of the second row. They consist of bundles of fibres, which take different directions.

2. Lateral Ligaments. Situated on the inner and outer side. The outer is extended between the scaphoides and trapezium; the inner, between the cuneiform and unciform bones.

3. Articulation of the os Pisiforme. Is by means of a separate *synovial membrane;* and it is further connected by short *ligamentous fibres* to the os unciforme.

4. Accessory Ligaments. Besides the ligaments above described, there are various *ligamentous slips,* extending in different directions, both on the palmar and dorsal side, which assist in connecting these bones.

5. Synovial Membrane. It extends from the three first bones of the upper row to the four of the lower row, sends off processes between them, and is continued to the articulations of the metacarpal bones.

b. Articulations between the Carpal and Metacarpal Bones.

The ligaments consist of slips, which run in various directions between these bones, and are strongest on the dorsal side. They are so short as only to allow of a slight yielding motion.

The ligamentous fibres of the first metacarpal bone are longer and stronger, extending from the trapezium upon it. And to this joint there is a peculiar synovial membrane.

c. ARTICULATIONS BETWEEN THE METACARPAL BONES. The four metacarpal bones, which support the fingers, have smooth articular surfaces at their posterior extremities, where they are in contact with each other, and processes of the common synovial membrane of the carpus are generally extended to them. The ligaments of these bones are :—

1. ANTERIOR AND POSTERIOR. Situated at the posterior extremity, consisting of transverse fibres.

2. ANTERIOR, or interosseous. Situated at the anterior extremity, or at the heads. They consist of transverse fibres, which are much stronger than the former, but are longer; and allow, therefore, of more motion. They are placed on the palmar side of the hand, and connect the heads of the four metacarpal bones of the fingers to each other.

d. ARTICULATIONS OF THE METACARPAL BONES AND FINGERS, OF THE BONES OF THE PHALANGES, AND OF THE BONES OF THE THUMB.

The capsules and ligaments of these joints do not differ from each other. They consist of *capsules,* formed by synovial membrane, which inclose the articular surfaces; and *lateral ligaments,* situated at the sides of the joints, which adhere to and strengthen them.

PRACTICAL POINTS.—*Dislocations* of the thumb. *Amputation* of the fingers; which requires a knowledge of the actual situation of the joint connected with external appearance.

CHAPTER III.

Of the Muscles of the Lower Extremity.

It is unnecessary to repeat here the observations with which the dissection of the upper extremity was introduced. They may, however, be easily referred to, chap. I. should the lower extremity be dissected first.

The Muscles of the Lower Extremity are distributed into REGIONS about the Pelvis, on the Thigh, the Leg, and the Foot.

§ 1. REGIONS ABOUT THE PELVIS.

a. LUMBAR, containing the

1. QUADRATUS LUMBORUM. Situated between the last rib, the crista of the ilium, and spine.
Origin. Broad tendinous and fleshy, from the posterior part of the spine of the os ilium.
Insertion. Into the transverse processes of all the lumbar vertebræ, into the last rib near the spine, and by a small tendon into the side of the last dorsal vertebra.

2. PSOAS MAGNUS. Is a considerable muscle, situated close to the lumbar vertebræ.
Origin. By distinct slips from the side of the body, and from the transverse process of the last dorsal vertebra, and in the same manner from the bodies and transverse processes of all the lumbar vertebræ. These unite to form a rounded fleshy belly, which descends before the inner part of the iliacus, then over the junction of the os pubis and ilium, and terminates in a strong tendon.
Insertion. Tendinous and fleshy into the trochanter minor and body of the os femoris, a little below that process.

3. PSOAS PARVUS. Is a smaller muscle than the former, and is sometimes wanting.

Origin. Fleshy from the side of the bodies of the two uppermost lumbar vertebræ, and sometimes from the last dorsal vertebra. It sends off a long slender tendon, which descends upon the inner side of the psoas magnus: from which an aponeurosis extends upon the adjacent muscles.

Insertion. Into the brim of the pelvis, at the junction of the os pubis and ilium.

4. ILIACUS. Fills up the venter of the ilium, and hence is sometimes called *iliacus internus.*

Origin. Tendinous and fleshy from the transverse process of the last lumbar vertebra, from the inner labium of the spine of the ilium, and from the edge of the bone, as far as the anterior and inferior spinous process; likewise fleshy from the hollow of the ilium, which it fills up, and from the aponeurosis, which covers it. The fibres converge as they descend, and join with the psoas magnus, where it becomes tendinous.

Insertion. With the psoas magnus.

Between the common tendon of the psoas magnus and iliacus and the capsular ligament of the hip-joint, is situated a considerable *bursa mucosa;* and a smaller one between it and the trochanter minor.

b. PELVIC, containing the

1. OBTURATOR INTERNUS. Is so called from covering the inside of the obturator foramen.

Origin. From more than half of the internal surface of the circumference of the obturator foramen, formed by the os pubis and ischium. The Obturator Internus consists of radiated fasciculi of fibres, which converge towards a strong tendon, and are covered by an aponeurosis. The muscle changes its direction, passes out of the pelvis over the smooth surface between the spinous process and tuberosity of the ischium, covered by the sacro-sciatic ligament.

Insertion. By a strong tendon into the middle part of the cavity at the root of the trochanter major. Observe, this muscle should not be displayed till the muscles of the ischiadic region have been dissected.

Between the tendon of this muscle, the gemini and the trochanter major is placed a *bursa mucosa;* and another *bursa* between the spinous process and tuberosity of the ischium.

2. COCCYGEUS.

Origin. Tendinous and fleshy from the spinous process of the ischium, covers the sacro-sciatic ligament, upon which it spreads in its course.

Insertion. Into the extremity of the sacrum and side of the os coccygis.

c. Gluteal, containing the

1. Gluteus Maximus. It forms the outermost layer of the three composed by the muscles of the buttock.

Origin. Tendinous and fleshy from the posterior part of the outer labium of the spine of the ilium, from the under part of the external surface of the os sacrum, from the posterior sacro-sciatic ligament, over which part of the lower edge of this muscle is folded, and from the os coccygis. The fleshy fibres run obliquely downwards and forwards, forming a thick and broad muscle, which is composed of coarse and loosely connected fasciculi, intermixed with and covered by a considerable quantity of adipose membrane. The upper part of it covers the trochanter major, and it is connected with the tendinous expansion which covers the thigh.

Insertion. By a strong, thick, and broad tendon into the upper and outer part of the linea aspera, extending from the trochanter major for some way downwards.

Several *bursæ mucosæ* are situated on the internal surface of the tendon of this muscle. The most considerable is found between it and the external surface of the trochanter major. A considerable, but smaller one, is placed between its broad tendinous expansion and the upper part of the vastus externus, and two smaller ones commonly between the muscle and the os femoris, at the upper and back part of the thigh.

2. Gluteus Medius. Is likewise a considerable muscle, but smaller than the former. It forms the second layer, and is displayed by dissecting back the gluteus maximus, after detaching this muscle from its origin.

Origin. Fleshy from the anterior and superior spinous process externally, from a large share of the outer lip of the ilium, and posteriorly from the dorsum of the bone. The fore and upper part of the muscle is covered by a continuation of the fascia of the thigh, from which it receives numerous fleshy fibres.

Insertion. By a strong short tendon into the outer and back part of the trochanter major.

A *bursa* is placed between this muscle and the upper part of the trochanter major.

3. Gluteus Minimus. Forms the third layer,

and is displayed by dissecting back the gluteus medius. This should be done cautiously, without raising with it the pyriformis muscle.

Origin. Fleshy from a semilunar ridge, which is continued from the anterior and superior spinous process of the ilium, across the dorsum of the bone as far as its notch, and from the dorsum of the ilium below.

Insertion. By a strong short tendon into the fore and upper part of the trochanter major.

A small *bursa* is situated between it and the trochanter major anteriorly.

d. ISCHIADIC, containing the

1. PYRIFORMIS. So named from its figure.

Origin. Within the pelvis, by three tendinous and fleshy origins from the second, third, and fourth pieces of the sacrum. It passes out of the pelvis through the upper part of the sacro-iliac notch, and receives an addition of some fibres from the ilium. It tapers in its descent, and is sometimes divided for the passage of the sciatic nerve.

Insertion. By a rounded tendon into the upper part of the cavity on the inside of the trochanter major.

A *bursa* is situated between its tendon and the upper of the gemini muscles.

2. GEMINI. Are two small muscles situated the one above the other, inclosing that part of the obturator internus, which is exterior to the pelvis. The insertion of the obturator internus is seen in this part of the dissection.

Origin. The superior from the spinous process, and the inferior from the tuberosity of the ischium, and from the posterior sacro-sciatic ligament.

Insertion. Tendinous and fleshy into the cavity on the inside of the trochanter major, on each side of the tendon of the obturator internus, to which they firmly adhere.

3. QUADRATUS FEMORIS. Is so named from its figure, and is situated below the gemini.

Origin. Tendinous and fleshy from the outside of the tuberosity of the ischium. It runs transversely outwards.

Insertion. Fleshy into the ridge, which is extended between the roots of the large and small trochanter. Under it is situated a portion of the obturator externus.

Between the muscle and the less trochanter is placed a *bursa*.

§ 2. ON THE THIGH.

FASCIA OF THE LOWER EXTREMITY. The greater number of the muscles of the lower extremity are covered by a tendinous expansion or aponeurosis. On the thigh it is called the fascia lata, and on the leg the aponeurosis cruralis. There is also a tendinous expansion on the sole of the foot, called the aponeurosis plantaris.

The *fascia lata* begins from the fore part of the gluteus maximus, from the fore part of the outer labium of the crista of the ilium, and from Poupart's ligament; from these parts it descends over the muscles of the thigh as far as the knee, and sends in processes between them. It is thickest on the outside, and thinnest on the inside of the thigh, being in that situation scarcely distinguishable from cellular membrane.

The *aponeurosis of the leg* is continuous with that of the thigh, and then passes down over the muscles of the leg as far as the foot. It is fixed above to the heads of the tibia and fibula, and in its descent to the spine of the tibia. It is most considerable in thickness on the fore and outer part of the leg. Below, the fascia forms at the fore part of the ankle-joint the ligamentum transversum tarsi (ligamentum cruciatum), where it is strongest and thickest. This ligament is formed of two decussating bands, one of which passes from the outer malleolus downwards and inwards as far as the metatarsal bone of the great toe, and the other passes from the inner malleolus in the opposite direction to be fixed to the metatarsal bone of the little toe. Below both are continuous with the thin tendinous expansion which covers the dorsum of the foot.

The tendinous covering of the lower extremity need not be displayed at once; but its different parts may be examined during the prosecution of the dissection of the muscles.

a. OUTER CRURAL, containing the

1. TENSOR VAGINÆ FEMORIS.

Origin. Tendinous from the anterior and superior spinous process of the ilium externally, extends downwards and backwards.

Insertion. A little below the trochanter major into the inside of the fascia lata.

After dissecting this muscle the fascia lata may be laid bare on the outside of the thigh.

b. ANTERIOR CRURAL, containing the

1. **Sartorius.** Is a slender flat muscle, which has an oblique course over the fore and inner part of the thigh.

Origin. Tendinous from the anterior and superior spinous process of the ilium. It passes at first over the tendon of the rectus, goes inwards and downward over the adductor longus and magnus, and descends below on the inner side of the thigh. In the middle third of the thigh it covers the femoral vessels: a knowledge of its relative situation is therefore extremely important, and in dissecting it the attachments to the parts beneath should be left untouched.

Insertion. By a broad thin tendon, which is expanded on the inner surface of the tibia near the lower part of its tubercle.

The principal vessels of the lower extremity take their course for some way on the anterior part of the thigh; they then descend along the inner part of the thigh, covered by the sartorius muscle, to the posterior part, and are situated in the ham. At the lower edge of the popliteus muscle, they divide; one set is placed on the anterior part of the leg near to, and on, the outer side of the tibia; while those, placed posteriorly, take the course of each side of the leg, pass close by the tibia and fibula, and terminate ultimately in the toes.

2. **Rectus.**

Origin. Tendinous by two strong attachments; the one from the anterior and inferior spinous process of the ilium, and the other from the dorsum of the ilium, a little above the acetabulum. They form by their union a single strong tendon, which descends down the middle of the fore part of the thigh, forming a strong double penniform muscle, which terminates below in a strong flat tendon.

Insertion. Tendinous into the base of the patella.

3. **Vastus Externus.** Forms the fleshy mass on the outside of the thigh, and is the strongest extensor of the leg.

Origin. Broad tendinous and fleshy from the fore and outer part of the root of the trochanter major, and from the outer side of the greater part of the linea aspera. The fibres run obliquely downwards and forwards.

Insertion. Tendinous into the outer and upper part of the patella, and is connected with the tendon of the rectus.

4. **Vastus Internus.** Is smaller than the former, and covers the inner side of the os femoris.

Origin. Tendinous and fleshy from the fore and upper part of the os femoris, extending as high as the rough line between the trochanter major and minor, and from the upper part of the inside of the linea aspera. Its fibres pass obliquely downwards and forwards. It is connected below with the tendon of the rectus.

Insertion. Tendinous into the inner and upper part of the patella.

5. **CRURALIS.** Is situated between the vasti, and covers the fore part of the os femoris.

Origin. Fleshy below the former muscle, from the larger part of the anterior and external surface of the os femoris. The larger part of this muscle is covered by the vasti, and is intimately connected with both these muscles.

Insertion. Into the upper part of the patella, behind the rectus. Between the tendon of this muscle, that of the vastus externus, the capsule of the knee-joint, and the patella, is situated a *bursa mucosa,* which frequently opens into the joint.

c. INNER CRURAL, containing the

1. **PECTINEUS** (pectinalis).

Origin. Broad, thin, and fleshy, from the fore part of the body of the os pubis, above the obturator foramen, and passes somewhat obliquely downwards.

Insertion. By a flat, short tendon into the fore and upper part of the linea aspera.

2. **GRACILIS.**

Origin. By a thin tendon from the os pubis, near to the symphysis pubis. It forms a slender, flat muscle, which descends on the inner side of the thigh.

Insertion. Tendinous, into the inner and upper part of the tibia, below and behind the sartorius.

TRICEPS ADDUCTOR FEMORIS. Under this term are often comprehended the three other muscles in this region, which are more properly distinguished as

3. **ADDUCTOR LONGUS FEMORIS.** Situated the most anteriorly.

Origin. By a strong round tendon from the upper and fore part of the os pubis, and from the fore part of the symphysis pubis, passes obliquely downwards and outwards, and spreads in its descent.

Insertion. Tendinous into the back part of the linea aspera, about its middle, and is continued some way down.

4. **ADDUCTOR BREVIS FEMORIS.**

Origin. By a short tendon, immediately below and behind the former, from the fore part of the os pubis, near the symphysis pubis. It passes downwards and outwards.

Insertion. Tendinous, into the back part of the root of the trochanter minor, and into the upper third of the linea aspera. It is connected, more or less, with the pectineus and the adductor magnus.

5. ADDUCTOR MAGNUS FEMORIS. Is by far the largest of the three.

Origin. Tendinous and fleshy, lower than the former from the ramus of the os pubis, and from the ramus and tuberosity of the ischium. Its fibres pass with different degrees of obliquity outwards and downwards.

Insertion. Behind the pectineus, and other adductors, into the whole length of the edge of the linea aspera, into the ridge which extends from it to the condyle of the os femoris, and by a roundish tendon into the inner condyle. Its tendon forms a passage for the femoral vessels.

6. OBTURATOR EXTERNUS. Is the deepest seated of the muscles in this region: it covers the obturator foramen.

Origin. From the os pubis and os ischium, where forming the circumference of the obturator foramen, and from the ligamentous expansion which occupies that opening. The fibres converge and pass outwards behind the cervix of the os femoris.

Insertion. By a strong tendon, into the cavity at the root of the trochanter major.

d. POSTERIOR CRURAL, containing the

1. SEMI-TENDINOSUS. So called from an oblique tendinous intersection in its fleshy part.

Origin. By a tendon which is united with that of the long head of the biceps flexor cruris, from the posterior part of the tuberosity of the ischium; it terminates in a long, roundish tendon.

Insertion. Into the upper part of the inner surface of the tibia, immediately below the gracilis, its tendon spreading at that part.

Between the upper tendon of this muscle, that of the semimembranosus, and the long head of the biceps, is placed a *bursa*. A second *bursa*, or sometimes more than one, is situated between the under tendon of this muscle, the tendon of the gracilis, and the internal lateral ligament of the knee-joint.

2. SEMI-MEMBRANOSUS. Although so called, it is remarkable from being in a considerable part composed of

tendon, its fleshy belly passing between a strong, oblique, tendinous portion at the upper and under part.

Origin. By a strong broad tendon, beneath the former, from the upper and back part of the tuberosity of the ischium.

Insertion. By a strong tendon into the inner and back part of the head of the tibia.

A *bursa* is situated between its upper tendon and the quadratus femoris. Another *bursa* is found between its under tendon, the inner head of the gastrocnemius, and the capsule of the knee.

3. BICEPS FLEXOR CRURIS.

Origin. By two heads. The long head arises between the two former muscles from the back part of the tuberosity of the ischium, by a short, but strong tendon. The short head arises from the linea aspera, a little below the insertion of the gluteus maximus, by a sharp, fleshy attachment. The fleshy bellies of the two heads unite, and are attached below to a strong tendon.

Insertion. Tendinous, into the upper part of the head of the fibula.

A *bursa* is found between the lower tendon of this muscle and the external lateral ligament of the knee.

The flexors of the leg above described diverge above and behind the knee; the semi-tendinosus and semi-membranosus passing down on the inner side, and the biceps flexor cruris on the outer side, thus leave a space, occupied by cellular membrane, through which the popliteal vessels pass. The projections, which they form, may be distinguished before the integuments have been removed: they are termed the ham-strings, of which the inner is formed by the semi-tendinosus and semi-membranosus, and the outer by the biceps. The popliteus muscle cannot be dissected till the gastrocnemius externus has been raised.

§ 3. ON THE LEG.

The *aponeurosis* is to be attended to in the dissection, which has been already described. The regions into which the muscles are distributed, are:

a. The ANTERIOR, containing the

1. TIBIALIS ANTICUS. Is situated close to the tibia, and is the strongest of the anterior muscles.

Origin. Tendinous and fleshy, from the under and outer part of the head of the tibia, close to the peroneus longus. It continues to arise from about three fourths of the outer surface of the tibia, along which it passes down the leg, from a large share of the interosseous ligament, and from the aponeurosis of the leg above. Its fibres pass obliquely to a strong, round tendon, which passes off from it below, and is continued over the fore part of the extremity of the tibia, and behind the transverse ligament of the ankle, to the inner side of the foot.

Insertion. Into the inside of the os cuneiforme internum, and base of the metatarsal bone that supports the great toe.

The tendon of this muscle is inclosed in a *sheath* of synovial membrane.

2. EXTENSOR LONGUS COMMUNIS DIGITORUM. Is situated on the outer side of the former muscle.

Origin. Tendinous and fleshy from the outer part of the head of the tibia, from the head and anterior edge of the fibula, and from the interosseous ligament; and above from the aponeurosis of the leg. Its fibres pass obliquely downwards and forwards to a tendon which runs along its anterior edge. The tendon is continued behind the transverse ligament of the ankle, and near that part divides into five slips.

Insertion. The outermost and shortest of these is attached to the base of the metatarsal bone of the little toe; the fleshy fibres which belong to this tendon are sometimes separated from the common extensor, and form a muscle which has been called the *Peroneus tertius.* The four other tendinous slips are expanded over the upper surface of the phalanges of the four smaller toes, to which they are attached. These tendons should be traced to their termination.

A *bursa* is situated between the tendon of this muscle and the capsule of the ankle-joint.

3. EXTENSOR LONGUS PROPRIUS POLLICIS. Is found between the two former muscles.

Origin. Tendinous and fleshy from the inner part of the fibula, beginning some way below the head, and continued to near its extremity, and from the interosseous ligament. Its fibres pass obliquely to a tendon which runs along its anterior edge, and is continued in a separate passage behind the transverse ligament of the ankle, and runs on the inner side of the foot.

Insertion. Into the second bone of the great toe.

The tendon of this muscle is included on the dorsum of the foot in a *sheath* of synovial membrane.

b. POSTERIOR SUPERFICIAL, containing the

1. GASTROCNEMIUS EXTERNUS (gemellus). Is

a muscle of considerable size and strength, being that by which the calf of the leg is principally formed.

Origin. By two distinct tendinous heads from the os femoris immediately above the upper and back part of the condyles of that bone. The two heads are narrow above, but become broader and thicker as they descend and unite a little below the knee-joint in a middle tendon. The muscle terminates in a thin, broad tendon, which joins below with the tendon of the next muscle.

Insertion. With the gastrocnemius internus.

2. GASTROCNEMIUS INTERNUS (soleus). Is situated under the former. In order to display it, the gastrocnemius externus must be raised from its origin, and dissected downwards.

Origin. From the posterior surface of the tibia, its attachment being continued obliquely along the under edge of the popliteus, from the upper and back part of the head of the fibula, and from the posterior surface and outer edge of the fibula for some way down. From these attachments it passes down before the gastrocnemius externus, in the form of a thick fleshy belly, which reaches below the fleshy part of the former muscle, and is attached to the common tendon; the exterior being covered by numerous tendinous fibres.

Insertion. With the former muscle by a strong, rounded tendon, called the Tendo Achillis, into the upper and posterior part of the tuberosity of the os calcis.

A considerable *bursa* is placed between the tendo Achillis and the tuberosity of the os calcis.

3. PLANTARIS. Covered by the outer head of the gastrocnemius externus.

Origin. Fleshy from the back part of the outer condyle of the os femoris. It has a small, fleshy belly, which adheres to the capsule of the joint in its descent, and soon terminates in a long, slender, thin tendon. The tendon passes down between the gastrocnemii, then runs along the inner edge of the tendo Achillis.

Insertion. Into the inner and back of the tuberosity of the os calcis, but is frequently spread in the cellular membrane, about the heel. It is not unfrequently found wanting.

c. POSTERIOR DEEP, containing the

1. POPLITEUS. Situated at the back part of the knee-joint.

Origin. By a round tendon from the under and back part of the outer condyle of the os femoris; it descends over the back part of the joint, forming a broad, thin, triangular, fleshy belly which adheres to the capsule, is composed of oblique fibres, and is covered by a tendinous expansion.

Insertion. Fleshy, into the upper and inner part of the posterior surface of the tibia.

Between this muscle, the outer condyle, the outer semilunar cartilage, and the capsule of the joint, is situated a *bursa,* which frequently communicates with the joint.

2. TIBIALIS POSTICUS. Is situated above, between the common flexor of the toes and the flexor of the great toe.

Origin. Fleshy from the upper half (nearly) of the posterior surface of the tibia, from the inner surface of the fibula, and from the greater part of the interosseous ligament. The fleshy fibres pass obliquely to a middle tendon, which descends from the muscle through the cartilaginous fossa, behind the inner malleolus, and is continued in a similar groove on the upper part of the astragalus to the sole of the foot. At that part the tendon usually contains a sesamoid bone, and divides into two slips.

Insertion. One of the tendinous slips is attached entirely to the os naviculare. The other divides into several slips, which are fixed to the os naviculare, astragalus, and the three ossa cuneiformia.

The tendon of this muscle, where it passes into the sole, is surrounded by a sheath of synovial membrane.

3. FLEXOR LONGUS DIGITORUM COMMUNIS (profundus perforans). Is a thin penniform muscle.

Origin. Tendinous and fleshy, from more than half of the posterior surface of the tibia, except that portion which is covered by the popliteus. Its fibres pass obliquely downwards and forwards towards a strong tendon which runs along its edge, and is continued behind the tibia, thence (through a depression lined by cartilage) along the astragalus, where it is bound down by a ligamentous sheath. About the middle of the sole of the foot it divides into four tendons, but just before its division, it is joined by a tendinous slip from the flexor pollicis longus.

Insertion. Into the bones of the third phalanx of the four lesser toes, after passing through the divisions in the tendons of the flexor brevis digitorum.

The tendon of this muscle where passing along the tibia, is inclosed in a synovial *sheath.* A second surrounds the tendon, and that of the flexor pollicis longus in the sole. The tendons on each toe, with those of the flexor brevis, are included in proper sheaths of synovial membrane.

4. **Flexor Pollicis Longus.** Is shorter, but stronger than the former muscle.

Origin. Tendinous and fleshy, by a double order of fibres from the greater part of the lower half of the posterior surface and outer edge of the fibula, with the exception of the undermost portion. The fibres pass obliquely to a middle strong tendon, which passes inwards behind the tibia to the sole of the foot, being continued in a cartilaginous groove of the os calcis, through a ligamentous sheath, and then runs along the abductor pollicis.

Insertion. Into the under part of the second bone of the great toe.

The tendon of this muscle is included in a synovial *sheath* at the os calcis, and at the great toe.

Before we trace the tendons of the above muscle to their insertion, it is necessary to dissect the middle of the sole of the foot, or the middle plantar region. The integuments are first to be dissected back, in order to display the *Aponeurosis plantaris.* This, like that of the palm of the hand, is a strong tendinous expansion, which covers the muscles, vessels, and nerves of the sole. It is attached posteriorly to the tuberosity of the os calcis, and extends forwards to the roots of the toes, and at the sides upon the muscles, being strongest in the middle and behind. It is more or less distinctly divided into three portions, the two lateral being spread upon the muscles of the great and little toes. The middle portion, which is the most considerable, is subdivided into five slips, which split at the toes, and are fixed on each side at their roots.

In the *middle plantar region,* besides the tendons of the muscles already described, are situated

1. **Flexor Brevis Digitorum Communis** (sublimis perforatus). It is covered immediately by the aponeurosis.

Origin. Tendinous and fleshy from the under and fore part of the tuberosity of the os calcis, and from the aponeurosis plantaris. It forms a thick short fleshy belly which sends off four small tendons, and these divide to form passages for the tendons of the flexor longus.

Insertion. Into the bones of the second phalanx of the four small toes.

2. **Flexor Digitorum Accessorius** (massa carnea Jacobi Sylvii). Is covered by the former muscle.

Origin. By two portions. The inner and smaller fleshy from the ligament which is stretched between the astragalus and tuberosity of the os calcis; the outer and larger tendinous, but soon becoming fleshy from the fore and outer part of the tuberosity of the os calcis.

Insertion. Into the tendon of the flexor longus before it divides.

3. LUMBRICALES. Are four small muscles, which resemble those in the palm of the hand.

Origin. Tendinous and fleshy from the tendon of the flexor longus just before its division.

Insertion. By slender tendons which spread on the inside of the first joint of the four small toes, and are fixed to the bones of the first phalanx and tendons of the extensors.

We now return to the dissection of the muscles of the leg.

d. FIBULAR, containing the long and short peroneal muscles which are placed close to the fibula.

1. PERONEUS LONGUS.

Origin. Tendinous and fleshy from the head, from the upper and smaller half of the anterior surface, and from the outer edge of the fibula; the fibres pass obliquely to a strong tendon, which is continued along the fibula, and descends behind the outer malleolus, where it runs through a ligamentous sheath. It is then turned forwards and passes through a groove in the os cuboides, and runs inwards across the sole, covered by the muscles at that part.

Insertion. Into the metatarsal bone of the great toe, and the os cuneiforme internum.

In the tendon opposite the cuboid bone is usually found a sesamoid bone. A considerable *bursa* surrounds the tendon at the outer malleolus; and another extends with it into the sole of the foot.

2. PERONEUS BREVIS.

Origin. By a sharp fleshy attachment above and by a double order of oblique fibres from the lower part of the anterior surface, and from the outer edge of the fibula to near the outer malleolus. The fibres are attached to a strong middle tendon which becomes rounder, and descends from the muscle in a groove behind the outer malleolus, being there included in the same ligament with that of the former muscle; but afterwards in a sheath of its own.

Insertion. Into the base of the metatarsal bone which supports the little toe.

The tendon of this muscle is surrounded by a bursa of its own at the outer side of the foot, in addition to that which it has in common with the peroneus longus.

§ 4. ON THE FOOT.

a. DORSAL, containing the

1. EXTENSOR BREVIS DIGITORUM COMMUNIS.

Origin. Tendinous and fleshy from the fore and upper part of the os calcis. It is formed of four slender fleshy bellies, which pass obliquely inwards, and terminate in an equal number of tendons.

Insertion. Into the upper part of the first bone of the great toe, and of the three small toes which are next to it, the tendons spreading upon these and intermixing with the tendinous expansions of the long extensor of the small toes.

On the sole of the foot the middle plantar has been described.

The remaining regions are the

b. INNER PLANTAR, containing the

1. ABDUCTOR POLLICIS.

Origin. Tendinous and fleshy from the inside of the protuberance of the os calcis, and from the fore and projecting part of the same bone.

Insertion. Tendinous into the inner sesamoid bone, and into the root of the first bone of the great toe.

2. FLEXOR BREVIS POLLICIS.

Origin. Tendinous from the under and fore part of the os calcis and os cuneiforme externum. Its fleshy belly is usually divided into two portions, and is intimately connected with the adductor and abductor pollicis.

Insertion. Into the ossa sesamoidea and the root of the first bone of the great toe.

3. ADDUCTOR POLLICIS.

Origin. Tendinous from the os calcis, the os cuboides, the os cuneiforme externum, and the root of the metatarsal bone of the second toe.

Insertion. Into the outer sesamoid bone and root of the metatarsal bone of the great toe.

c. OUTER PLANTAR, containing the

1. ABDUCTOR MINIMI DIGITI.

Origin. Tendinous without and fleshy within from the under and back part of the protuberance of the os calcis, and from the base of the metatarsal bone of the little toe.

Insertion. Tendinous into the outer side of the root of the first bone of the little toe.

2. FLEXOR BREVIS MINIMI DIGITI.

Origin. Tendinous from the os cuboides, near the groove, in which the tendon of the peroneus longus is lodged; and fleshy from the base of the metatarsal bone, which supports the toe.

Insertion. Into the anterior extremity of the metatarsal bone, and the root of the first bone of the little toe.

d. INTEROSSEAL, containing the

1. TRANSVERSALIS. Runs transversely across the extremities of the metatarsal bones, above the tendons of the flexor muscles.

Origin. Tendinous from the under part of the anterior extremity of the metatarsal bone of the great toe, and from the outer sesamoid bone.

Insertion. Into the under and outer part of the metatarsal bone of the little toe.

2. INTEROSSEI PEDIS.

In the foot as in the hand are seven small muscles, which are situated in the spaces between the metatarsal bones, arising from their posterior extremities and sides; while their tendinous insertions intermix with the tendons of the extensors of the toes. These consist of four external and of three internal muscles, and are thus distinguished:—

INTEROSSEI PEDIS EXTERNI, BICIPITES.

1. PRIOR INDICIS PEDIS.

Origin. Tendinous and fleshy, by two origins, from the roots of the metatarsal bones of the fore-toe and of the great toe.

Insertion. Tendinous, into the inside of the root of the first bone of the fore-toe.

2. POSTERIOR INDICIS PEDIS.

Origin. Tendinous and fleshy, from the roots of the metatarsal bones of the fore and middle toes.

Insertion. Tendinous, into the outside of the root of the first bone of the fore-toe.

3. POSTERIOR MEDII DIGITI PEDIS.

Origin. Tendinous and fleshy, from the roots of the metatarsal bones of the middle and third toes.

Insertion. Tendinous, into the outside of the root of the first bone of the middle toe.

4. POSTERIOR TERTII DIGITI PEDIS.

Origin. Tendinous and fleshy, from the roots of the metatarsal bones of the third and of the little toe.

Insertion. Tendinous, into the outside of the root of the first joint of the third toe.

INTEROSSEI PEDIS INTERNI.

1. PRIOR MEDII DIGITI PEDIS.

Origin. Tendinous and fleshy, from the inside of the root of the metatarsal bone of the middle toe.

Insertion. Tendinous, into the inside of the root of the first bone of the middle toe.

2. PRIOR TERTII DIGITI PEDIS.

Origin. Tendinous and fleshy, from the inside and inferior part of the root of the metatarsal bone of the third toe.

Insertion. Tendinous, into the inside of the root of the first bone of the third toe.

3. PRIOR MINIMI DIGITI PEDIS.

Origin. Tendinous and fleshy, from the inside of the root of the metatarsal bone of the little toe.

Insertion. Tendinous, into the inside of the root of the first bone of the little toe.

§ TABLE EXHIBITING THE ACTIONS OF THE MUSCLES OF THE LOWER EXTREMITY:

Those, namely, by which the movements of the femur, leg, foot, tarsus, and toes, are performed. For some general observations see p. 20.

THE MOTIONS OF THE FEMUR upon the pelvis are those of *Extension*, or carrying it backward—*Flexion*, or carrying it forwards—*Abduction*, or carrying it outwards, as in separating the thighs—*Adduction*, or carrying it inwards, as in approximating the thighs—*Rotation*, or turning it upon its axis, either inwards or outwards. The muscles have, therefore, been divided into—*a.* EXTENSORS, *b.* FLEXORS, *c.* ABDUCTORS, *d.* ADDUCTORS, *e.* ROTATORS INWARD, *f.* ROTATORS OUTWARD.

a. EXTENSORS:

1. Gluteus maximus.
2. Gluteus medius (part of).
3. Pyriformis.
4. Obturator internus.
5. Gemini.
6. Quadratus.
7. Adductor magnus (portion from the tuber ischii).
8. Biceps (long head of).
9. Semi-membranosus.
10. Semi-tendinosus.

b. FLEXORS.

1. Iliacus.
2. Psoas magnus.
3. Sartorius.
4. Tensor vaginæ femoris.
5. Gracilis.
6. Adductor longus.
7. Adductor brevis.
8. Adductor magnus.
9. Obturator externus.
10. Pectineus.
11. Rectus.

c. ABDUCTORS.

1. Gluteus magnus.
2. Gluteus medius.
3. Gluteus minimus.
4. Tensor vaginæ femoris.
5. Pyriformis.
6. Gemini.
7. Obturator internus.

d. ADDUCTORS.

1. Iliacus.
2. Psoas magnus.
3. Pectineus.
4. Gracilis.
5. Adductor longus.
6. Adductor brevis.
7. Adductor magnus.

8. Obturator externus.
9. Quadratus.

e. ROTATORS OUTWARD.

1. Gluteus magnus.
2. Gluteus medius.
3. Pyriformis.
4. Gemini.
5. Obturator internus.
6. Obturator externus.
7. Quadratus femoris.
8. Iliacus.
9. Psoas magnus.
10. Adductor longus.
11. Adductor brevis.
12. Adductor magnus.

f. ROTATORS INWARD.

1. Tensor vaginæ femoris.
2. Gluteus medius (anterior portion of).
3. Gluteus minimus (anterior portion of).
4. Sartorius.
5. Gracilis.

The MOTIONS OF THE LEG upon the thigh, are those of *flexion* and *extension*. There are also slight *rotations* when the leg is bent. The muscles, therefore, are divided into —*a.* EXTENSORS, *b.* FLEXORS, *c.* ROTATORS INWARD and OUTWARD.

a. EXTENSORS.

1. Rectus.
2. Cruralis.
3. Vastus externus.
4. Vastus internus.

b. FLEXORS.

1. Gracilis.
2. Sartorius.
3. Semi-tendinosus.
4. Semi-membranosus.
5. Biceps.

6. Gastrocnemius externus.
7. Plantaris.
8. Popliteus.

c. ROTATORS INWARD.

1. Gracilis.
2. Sartorius.
3. Semi-membranosus.
4. Semi-tendinosus.
5. Popliteus.

d. ROTATOR OUTWARD.

1. Biceps.

The MOTIONS OF THE FOOT upon the leg, are those of *extension*, by which the foot and toes are pointed downwards.—*Flexion*, by which the foot and toes are pointed upwards.—*Inflexions inward* and *outward*, which do not take place, however, in the ankle-joint, but between the two rows of the tarsal bones. The muscles may be divided into—*a*. EXTENSORS, *b*. FLEXORS, *c*. INFLECTORS INWARD, *d*. INFLECTORS OUTWARD.

a. EXTENSORS.

1. Gastrocnemius externus.
2. Gastrocnemius internus.
3. Plantaris.
4. Flexor longus digitorum.
5. Flexor longus pollicis.
6. Tibialis posticus.
7. Peroneus longus.
8. Peroneus brevis.

b. FLEXORS.

1. Tibialis anticus.
2. Extensor longus digitorum.
3. Extensor proprius pollicis.

c. INFLECTORS INWARD.

1. Tibialis posticus.
2. Extensor proprius pollicis.

3. Flexor longus digitorum.
4. Flexor longus pollicis.

d. INFLECTORS OUTWARD.

1. Peroneus longus.
2. Peroneus brevis.
3. Extensor longus digitorum.

The MOTIONS OF THE TOES are those of *flexion—extension—abduction—adduction.* The muscles, therefore, may be divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor longus digitorum.
2. Flexor brevis digitorum.
3. Flexor accessorius digitorum.
4. Lumbricales.
5. Flexor longus pollicis.
6. Flexor brevis pollicis.
7. Flexor brevis minimi digiti.

b. EXTENSORS.

1. Extensor longus digitorum.
2. Extensor brevis digitorum.
3. Extensor proprius pollicis.

c. ABDUCTORS.

1. Abductor pollicis.
2. Abductor minimi digiti.
3. Interossei: { Prior indicis.
   Prior medii digiti.
   Prior tertii digiti.

d. ADDUCTORS.

1. Adductor pollicis.
2. Transversalis.
3. Interossei: { Prior minimi digiti.
   Posterior indicis.
   Posterior medii digiti.
   Posterior tertii digiti.

CHAPTER IV.

Of the Joints of the Lower Extremity.

For general directions respecting the dissection of these parts, see p. 27.

The Joints of the lower extremity are—1. Those of the pelvis. —2. Hip-joint.—3. Knee-joint.—4. Those of the tibia and fibula. —5. Ankle-joint.—6. Joints of the foot.

§ 1. OF THE PELVIS.

The articulations of the bones of the pelvis are formed in part by ligamento-cartilaginous substances; and in part by ligaments: but distinct synovial capsules are not found.

a. Sacro-iliac Symphysis.

The anterior and smaller portion of the articulating surface of each bone is covered by a smooth cartilage. These cartilages touch each other but are seldom completely united, and are lubricated by a slippery fluid, of a thicker consistence than synovia.

On the other hand the posterior and larger portions are not covered by cartilage, but are firmly united by an exceedingly tough and strong *fibro-cartilaginous structure,* which has been sometimes described as a peculiar ligament under the name of the *sacro-iliac* (ligamentum sacro-iliacum).

The articulation is further strengthened by one posterior and two anterior ligaments.

1. Posterior (ligamentum pelvis posticum). Consisting of perpendicular and oblique fibres forming a strong broad ligament, which passes from the posterior extremity of the spine of the ilium to the transverse-like processes of the third and fourth pieces of the sacrum or false vertebræ. Besides these there are irregular *bands* which cross in different directions, and assist in strengthening the articulation.

2. **Anterior Superior** (ligamentum pelvis anticum superius). Is formed of oblique fibres, which pass from the posterior part of the spine of the ilium, and is fixed to the transverse processes of the fourth and fifth lumbar vertebræ. It is then triangular.

3. **Anterior Inferior** (ligamentum pelvis anticum ~~posticum~~ inferius). Passes from the same part, and is attached to the transverse process of the fifth lumbar vertebra.

b. Symphysis Pubis.

The ossa pubis where they form the symphysis are each covered by a layer of cartilage united by a *fibro-cartilaginous substance.* The union is seldom complete, and is found to vary considerably in degree, being generally separate to a greater or less extent, with a corresponding difference in the quantity of the fibro-cartilaginous substance.

The uniting medium of the symphysis is covered by a strong *layer of ligament,* which is composed of transverse fibres. These are strongest at the lower part, and are attached to the bones of the pubis. This layer is sometimes described as a capsular ligament, and assists materially in strengthening the junction.

c. Articulation of the Os Coccygis with the Sacrum.

There is a *fibro-cartilaginous substance* interposed between the articulating surfaces of these bones, which forms a bond of union between them. The articulation is strengthened by *longitudinal ligaments,* which descend from the os sacrum, spread over the os coccygis, and connect its different portions together. The ligaments at the back part which pass between the bones are the most considerable.

d. Proper Ligaments of the Pelvis, or those which are not appropriated to the strengthening of the articulations.

1. **Posterior Sacro-ischiatic Ligament** (ligamentum sacro-ischiaticum posterius, tuberoso-sacrum). Situated at the under and back part of the pelvis. It arises from the transverse processes of the os sacrum, from the under and lateral part of that bone, and from the upper part of the os coccygis. It passes downwards and forwards, becomes considerably narrower and thicker, and is fixed to the tuberosity of the ischium.

2. ANTERIOR SACRO-ISCHIATIC LIGAMENT (ligamentum sacro-ischiaticum anterius, spinoso-sacrum). Is the smaller of the two. It arises from the same parts anterior to the former, passes forwards across it, and is fixed to the spinous process of the ischium. This ligament divides the sacro-ischiatic notch.

3. OBTURATOR LIGAMENT (ligamentum obturatorium). Is a thin ligamentous expansion composed of irregular fibres, which adhere to the margin of the foramen thyroideum, and fill the whole of that opening, except at the upper and outer part, where a passage is left for the obturator vessels and nerve. This opening is remarkable from its admitting occasionally of the descent of a hernia.

§ 2. OF THE HIP-JOINT.

The hip-joint is surrounded by thick and strong muscles, which contribute principally to give figure to this joint externally. From this circumstance some difficulties arise in the examination of this joint under accident or disease; it furnishes, however, a stronger reason for acquiring an intimate acquaintance with the form and proportions of the part in its natural and healthy state. The joint is composed of the os innominatum and os femoris, and the parts connected with it are:—of the os innominatum, the acetabulum, and the three bones of which it is composed which meet in the acetabulum; and of the os femoris, the head, neck, trochanter major, and trochanter minor. The only part which can be felt before the coverings have been removed is the trochanter major: but the joint itself is the least covered anteriorly.

1. CAPSULAR LIGAMENT. Is the largest and most compleat of any in the body. It is attached above to the outside of the brim of the acetabulum; it surrounds the head and neck of the os femoris, round the latter of which it is firmly connected. The external part is extended farther down than the internal, which is fixed to the neck by several separate bands or frœna. It is strongest at the upper, outer, and fore part; is composed of several layers of strong longitudinal fibres, and is strengthened by the surrounding muscles.

2. FIBRO-CARTILAGINOUS LIGAMENT OF THE ACETABULUM (ligamentum cotyloideum fibro-cartilagineum). Is seen on cutting open the capsular ligament. It is composed of a ligamento-cartilaginous substance, which surrounds and is attached to the brim of the acetabulum. It is stretched across

the breach in that cavity so as to compleat its edge, and increases the depth of the whole cavity. The breach is filled up by strong ligamentous bands.

3. ROUND LIGAMENT (ligamentum teres, rotundum). Arises by a broad flat attachment from the under and inner part of the cavity of the acetabulum. It passes upwards, becomes rounder, and is fixed by a broad attachment to the pit on the inner surface of the head of the os femoris. It is composed of longitudinal fibres, which are continued with the cartilaginous lip of the acetabulum.

4. SYNOVIAL MEMBRANE (membrana capsularis synovialis). Is continued from the acetabulum over the cartilaginous brim, lines the capsular ligament, and descends to the outer part of the neck, reaching farther down before than behind. It is then reflected back, and covers the neck to the cartilage of the head. The ligamentum teres is included also in a process of synovial membrane.

The greater part of the acetabulum is covered by cartilage except at its under and middle part, which is the deepest, and contains a considerable quantity of fat.

PRACTICAL POINTS. *Fractures*:—Of the acetabulum—of the neck of the os femoris (within the capsular ligament)—of the os femoris through the trochanter major.

Dislocations:—Of the head of the os femoris on to the dorsum of the ilium—into the ischiatic notch—into the obturator foramen—on to the os pubis.

§ 3. OF THE KNEE-JOINT.

This joint is situated superficially. Its figure is principally produced by the form of the bones which enter into its composition. It readily, therefore, admits of examination, and alterations in its form from accident or disease are detected without difficulty. It is composed of the os femoris, the tibia, and the patella; and the parts of these connected with the joint are:—of the os femoris, its condyles, their articular surfaces, and the depression between them: of the tibia, its head, the two articular surfaces, and the tubercle: of the patella, its articular surfaces.

The knee-joint is more complicated in its structure than any other joint of the body, in consequence of the number and disposition of its ligaments, which are situated both internally and externally, and are calculated to afford great strength to the articulation; and, besides these, by interarticular cartilages, which increase and deepen the surfaces of articulation.

a. LIGAMENTS SITUATED EXTERNALLY.

1. INTERNAL LATERAL LIGAMENT (ligamentum genu laterale internum). Is the strongest of these. It arises from the fore and inner part of the inner condyle of the os femoris, and is attached below to the upper part of the inner surface of the tibia. It is composed of perpendicular fibres, and is broader above than below.

2. LONG EXTERNAL LATERAL LIGAMENT (ligamentum laterale externum longum). Is a narrow rounded, but strong ligament, and is situated before the short. It arises from the outer part of the outer condyle, and is fixed below to the fore and outer part of the head of the fibula.

3. SHORT EXTERNAL LATERAL LIGAMENT (ligamentum laterale externum breve). Is less considerable than the former, and is situated behind it. It arises from the posterior part of the outer condyle, passes obliquely downwards, and is attached below to the head of the fibula.

4. POSTERIOR LIGAMENT (ligamentum posticum). Is formed of irregular bands which arise from the upper and back part of the outer condyle of the os femoris, descend obliquely, and are fixed below to the inner and back part of the head of the tibia.

5. LIGAMENT OF THE PATELLA. Is placed anteriorly, and is of great strength and size. It arises from the depression behind the apex of that bone, and is fixed below to the tubercle at the upper and fore part of the tibia. By means of this ligament the muscles inserted into the patella exert their action also on the tibia in the extension of the leg.

b. CAPSULE OF SYNOVIAL MEMBRANE (membrana capsularis synovialis). It arises from the whole circumference of the under end of the os femoris, anteriorly a little above the margin of the articulating cartilage, and posteriorly immediately above it. From this it descends and is fixed round the head of the tibia, and into the margin of the articulating surface of the patella, so that this bone projects somewhat into the cavity, and forms a part of the boundary of the joint. It is lost upon the articular cartilage of these parts. At the upper and fore part it lines also the under part of the extensors of the leg, and is connected to the other surrounding parts by a loose cellular texture.

The synovial membrane forms a fold on each side of the patella, in which are some ligamentous fibres, called the *alar ligament* (ligamentum alare). And another fold is extended from the patella to the depression in the os femoris, called the *mucous ligament* (ligamentum mucosum).

Depositions of adipose substance are found at different parts of the joint: for instance, about the circumference of the patella, in the above-mentioned fold, and between the projections of the thigh-bone.

c. LIGAMENTS SITUATED INTERNALLY.

These are the crucial ligaments, which most essentially contribute to strengthen the junction of the os femoris with the tibia. They arise from the depression between the condyles, and are so called from crossing each other. They are covered by the synovial membrane, but in fact are situated externally to it.

1. ANTERIOR CRUCIAL LIGAMENT (ligamentum cruciatum anterius). Arises from the inner side of the outer condyle of the os femoris; it passes downwards, inwards, and forwards, crossing the posterior ligament, and is fixed below to a depression on the fore-part of the head of the tibia, between the articulating surfaces.

2. POSTERIOR CRUCIAL LIGAMENT (ligamentum cruciatum posterius). Is stronger and broader than the former; it arises from the outer side of the inner condyle of the os femoris, it passes downwards outwards and backwards, and is fixed to a depression on the back part of the head of the tibia, a bony protuberance separating it from the insertion of the former.

d. INTERARTICULAR CARTILAGES. They are named from their figure, the semilunar.

THE SEMILUNAR CARTILAGES. Are broader behind than before; their outer convex edge is thick, while the inner concave edge is thin and sharp; they are hollowed out above so as to render the sockets for the condyles of the os femoris deeper, are more or less flat below, and they cover about two-thirds of the tibia. The inner edge is unattached; the outer is fixed to the circumference of the head of the tibia, by means of the capsule of the joint; their extremities are attached by strong fibrous bands to the protuberance between the articulating surface on the head of the tibia.

The anterior extremities of these cartilages are connected by a strong transverse band, called the *Transverse ligament* (ligamentum transversum).

Practical Points. *Fractures:*—Of the condyles of the os femoris—of the patella.

Dislocations of the tibia:—forwards, backwards, inwards, outwards—of the patella—of the interarticular cartilages.

Loose substances within the joint.

§ 4. OF THE TIBIA AND FIBULA.

a. Superior Articulation.

The head of the fibula is connected to the tibia by means of a short *capsule* of synovial membrane, which is strengthened on the exterior by *ligamentous bands,* which are extended obliquely between the bones. The articular surfaces of the bones are covered by a smooth cartilage.

b. In the Middle.

The tibia and fibula are connected by the *interosseous ligament.* It is a thin expansion, one edge of which is fixed to the outer and posterior angle of the tibia, the other to the corresponding ridge of the fibula. It occupies the spaces between the two bones, and is composed of oblique fibres. It has an opening above for the passage of the anterior tibial vessels, and is perforated besides in various parts for the passage of vessels and nerves.

c. Inferior Articulation.

It is formed by the adaption of the articular surfaces of the tibia and fibula, between which a duplicature of synovial membrane is extended from the ankle-joint, and by a strong ligament before and behind.

1. **Anterior** (ligamentum anterius). It arises from the outer and fore-part of the extremity of the tibia, and is attached to the outer malleolus of the fibula.

2. **Posterior** (ligamentum posterius). Is stretched between the corresponding points of the tibia and fibula on the posterior part.

§ 5. OF THE ANKLE-JOINT.

The bones which enter into the composition of this joint are the tibia, the fibula, and the astragalus. The parts of these bones, connected with the articulation, are the malleolus externus, the malleolus internus, the articular surfaces of the tibia and fibula, and the pulley-like articular surface and the lateral articular surfaces of the astragalus; all of which are covered by smooth cartilage. The parts which may be distinguished before the integuments have been removed, are the malleoli; but in consequence of being surrounded only by ligaments and tendon, the joint is so superficial that alterations in its form or motions are readily detected.

a. LIGAMENTS which connect the bones of the leg with those of the tarsus, namely with the os calcis, the astragalus, and the os naviculare.

1. DELTOID LIGAMENT of the tibia (ligamentum laterale internum deltoides). It arises from the malleolus internus, spreads as it descends, and is attached below to the astragalus, the os calcis, and the os naviculare.

2. ANTERIOR LIGAMENT of the fibula (ligamentum fibulæ anterius). It arises from the anterior part of the outer malleolus, and passing obliquely forwards and inwards, becomes fixed to the fore and outer part of the astragalus.

3. MIDDLE, OR PERPENDICULAR LIGAMENT of the fibula (ligamentum fibulæ medium perpendiculare). It arises from the extremity of the outer malleolus, and after descending nearly perpendicularly, is fixed below to the outer side of the os calcis.

4. POSTERIOR LIGAMENT of the fibula (ligamentum fibulæ posterius). It arises from the inner and back part of the outer malleolus, passes nearly transversely inwards, and is attached to the back part of the astragalus.

Besides these ligaments, the joint is further strengthened by *ligamentous fibres,* which extend upon the capsule from the tibia to the astragalus.

b. SYNOVIAL MEMBRANE (membrana articuli pedis synovialis). Arises from the margin of the articular surfaces of the tibia and fibula, and is attached to the circumference of the articular surfaces of the astragalus.

PRACTICAL POINTS. *Dislocations:*—inward—outward—and forward.

§ 6. OF THE FOOT.

Of the Tarsal Bones.

The bones of the tarsus are firmly united by the strong ligaments situated between the bones on the dorsal and plantar, and on the inner and outer side of the foot; and which are distinguished by names designative of their situation and of the bones which they connect. The applied surfaces of these bones are covered by cartilage, and included in synovial capsules: that which connects the first with the second row being the most remarkable of these articulations.

I. Of the Astragalus and Os Calcis.

Between the inferior surface of the astragalus and the upper part of the os calcis there is a distinct *synovial capsule:* in addition to which, there are strong ligaments uniting these bones (ligamenta astragalo-calcanea). They are as follow:

1. Interosseous Ligament (ligamentum interosseum). This consists of strong fibres, passing between the corresponding grooves which divide the opposite articular surfaces of these bones.

2. Posterior Ligament (ligamentum posterius). It passes from the back part of the astragalus to the inner and back part of the os calcis.

3. Anterior Ligament (ligamentum anterius). Passes from the inner part of the astragalus to the inner and fore part of the os calcis.

II. Of the First and Second Row of the Tarsal Bones.

There is a common *synovial membrane,* which incloses the opposed articular surfaces of the astragalus, the os naviculare, and the os calcis, and there is a distinct *synovial membrane* which includes the articular surfaces of the os calcis and the os cuboides. These bones are connected by the following ligaments.

Ligament between the Astragalus and Os Naviculare (ligamentum astragalo-scaphoideum).

SUPERIOR OR DORSAL LIGAMENT (ligamentum superius). It passes from the upper part of the astragalus to the upper part of the os naviculare.

LIGAMENTS BETWEEN THE OS CALCIS AND OS NAVICULARE (ligamenta calcaneo-scaphoidea).

1. EXTERNAL LIGAMENT (ligamentum externum). It passes from the fore part of the os calcis to the outside of the os naviculare.

2. INFERIOR OR PLANTAR LIGAMENT (ligamentum inferius). This very strong ligament passes from the under and fore part of the os calcis to the under part of the os naviculare.

LIGAMENTS BETWEEN THE OS CALCIS AND OS CUBOIDES (ligamenta calcaneo-cuboidea).

1. SUPERIOR OR DORSAL. It consists usually of several bands, which pass between the upper edges of the bones.

2. EXTERNAL. Is extended on the outside between these bones.

3. INFERIOR OR PLANTAR. Is the strongest of the tarsal ligaments. It passes at the under surface of the bones.

LIGAMENTS BETWEEN THE OS NAVICULARE AND THE OS CUBOIDES (ligamenta scaphoideo-cuboidea).

1. INTEROSSEOUS LIGAMENTS. A band of short transverse fibres which passes in the space between the bones.

2. SUPERIOR OR DORSAL LIGAMENT. Passes from the outer edge of the os naviculare to the upper surface of the os cuboides.

3. INFERIOR OR PLANTAR LIGAMENT. From the under part of the os naviculare to the inner edge of the os cuboides.

III. OF THE SECOND ROW OF TARSAL BONES.

LIGAMENTS BETWEEN THE OS NAVICULARE AND THE THREE OSSA CUNEIFORMIA (ligamenta scaphoideo-cuneiformia).

These bones are connected by *ligamentous bands*, both above and below, passing irregularly from the os naviculare to each of the bones. They are severally distinguished, as the *plantar* and *dorsal ligaments.* Besides these there is a *synovial capsule*, between the os nav. and the oss. cuneif., and penetrating the interspaces of the three latter bones.

LIGAMENTS BETWEEN THE OS CUBOIDES AND THE OS CUNEIFORME EXTERNUM (ligam. cuboideo-cuneiformia).

These likewise consist of *plantar* and *dorsal* ligaments, and there is a distinct *synovial membrane.*

LIGAMENTS BETWEEN THE OSSA CUNEIFORMIA (lig. cuneiformia).

Consist of irregular bands, called the *interosseous*, the *plantar* and the *dorsal* ligaments. Their synovial membrane is noticed above, as occupying the interspaces of these bones.

IV. OF THE TARSAL AND METATARSAL BONES.

Between the inner cuneiform bone and the base of the first metatarsal bone, a distinct *synovial membrane* is commonly found. Another and separate *synovial membrane* includes the articular surfaces of the second metatarsal bone, and the ossa cuneiformia. A third *synovial membrane* is found between the articular surfaces of the third cuneiform, and third metatarsal bone: and the articular surfaces of the third and fourth metatarsal bones are inclosed in a common capsule, which contains likewise the anterior surface of the os cuboides.

The *ligaments* which unite the metatarsal bones to those of the tarsus, consist of irregular bands, both on the upper and under surface, called *dorsal* and *plantar.*

The ligaments connecting the metatarsal bones to each other, the articulations between the metatarsal bones and those of the first phalanx, and the articulations between the bones of the toes, so nearly resemble the corresponding articulations in the hand, that it is not considered necessary to particularise their structure. See p. 35.

THE DISSECTOR'S MANUAL.

Section the Second.

IN TWO PARTS:

THE FIRST CONTAINING THE

DISSECTION OF THE HEAD, NECK, AND CHEST:

THE SECOND THE

DISSECTION OF THE ABDOMEN AND PELVIS.

SECTION THE SECOND.

PART I.

CONTAINING THE DISSECTION OF THE

HEAD, NECK, AND CHEST.

CHAPTER I.

Of the Head.

§ 1. OF THE MUSCLES ON THE EXTERIOR OF THE CRANIUM, DISTRIBUTED INTO REGIONS.

a. EPICRANIAL, containing the

1. OCCIPITO-FRONTALIS. Is a thin broad digastric muscle, which covers the cranium.

Origin. Tendinous and fleshy from the arched ridge of the os occipitis, and root of the mastoid process of the temporal bone. Its fleshy fibres ascend upon the occiput, and terminate in a thin broad tendon, which covers the vertex, and part of the sides, of the head. At the upper part of the forehead it again becomes fleshy, and descends upon the frontal bone.

Insertion. Into the skin of the eyebrows, intermixed with the musculus orbicularis palpebrarum, and sends a fleshy slip by the side of the nose, which intermixes with the compressor naris and levator labii superioris alæque nasi.

The tendon of this muscle firmly adheres to the skin, but is loosely connected beneath, so that it will require caution in the dissection not to raise it with the integuments of the cranium.

b. AURAL, containing the small muscles which move the whole auricle.

1. ATTOLLENS AUREM. Situated above the ear.

Origin. Thin and broad from the tendon of the occipito-frontalis.

Insertion. Into the upper part of the ear.

2. ANTERIOR AURIS. Situated anteriorly, but not always found.

Origin. From the posterior part of the zygoma.

Insertion. Into the back part of the helix anteriorly.

3. RETRAHENTES. Are two, sometimes three in number, situated behind the ear.

Origin. From the outer and back part of the root of the mastoid process.

Insertion. Into the back part of the concha.

The parts, which follow next in the dissection, are, the aponeurosis, and the fleshy portion of the temporal muscle, situated on the side of the head, but classed with the muscles in the maxillary region.

APONEUROSIS OF THE TEMPORAL MUSCLE. Is a strong tendinous expansion, which covers the whole of the upper and expanded part of the muscle. Above, it is attached around the circumference of the temporalis to the parietal and frontal bones; and below, to the whole of the zygoma and adjoining part of the os frontis. On dissecting this back, the temporalis will be laid bare.

TEMPORALIS. Covers the side of the head or temple.

Origin. Fleshy from the semicircular ridge of the parietal bone, and from the same bone below the ridge; from all the squamous portion of the temporal bone; from the temporal process of the sphenoid bone; from the external angular process of the os frontis; and from the above mentioned aponeurosis. From these attachments the fibres descend in radii, and are continued to the inside of the zygoma.

Insertion. This will be afterwards described.

§ 2. DISSECTION OF THE CONTENTS OF THE CRANIUM.

The upper part of the cranium is now to be removed for the purpose of dissecting the brain. An *incision* is first to be carried through the soft parts in a circular direction, and in the course in which the saw is afterwards to be applied: the line of incision should be made from about half an inch above the orbits, directly backwards on each side to the protuberance of the os occipitis. The *saw* is next to be applied in the same track, and a deep groove is to be formed by it, but without penetrating the inner table of the skull. Lastly, with a mallet and sharp edged elevator the inner table is to be *broken* through, and the skull-cap torn carefully from the dura mater.

OF THE BRAIN.

The term includes all the parts of the nervous mass, which, together with its membranes, fills the cavity of the cranium.

OF THE MEMBRANES.

They are three in number: 1. the Dura Mater; 2. the Pia Mater; 3. the Tunica Arachnoides.

DURA MATER. So called from being the firmest of the three membranes. Is first seen when the calvarium has been raised. It lines the whole interior of the cranium, and is extended with the spinal marrow through the vertebral canal. Adheres to the bones of the skull with considerable firmness; frequently, indeed, so firmly as not to be separated without laceration; especially in very young subjects, in consequence, probably, of the greater number of vessels of communication. In this manner it answers the purpose of a periosteum internally, numerous vessels passing from the membrane into the bones. These vessels are the principal cause of the adhesion: but at some parts the connexion is much more intimate, as at the sutures, from processes which pass in between them, and at the different foramina from processes which are continued along with the nerves. The exterior surface of the membrane appears rough after its separation, from the *torn* state of the vessels and cellular structure connecting it with the bone. The internal surface is smooth and unconnected, except where the veins enter the sinuses, and it is lubricated by a secretion which gives facility of motion, and prevents the ill effects of friction.

* [The cavity between these two membranes extends not only over the surface of the brain, but likewise along the whole length of the spinal marrow. The structure of the dura mater is dense, firm, and tendinous-like. It is one of the thickest and strongest membranes of the body. It has been said to be composed of layers: and you may, in fact, succeed in stripping parts into two or more thin portions, but it possesses no regularly laminated structure. It is made up of numerous tendinous-like fibres, which may be separated by maceration: they run in various directions, and are intimately matted together. Some of these have a shining appearance and are particularly distinct on the inner surface. The dura mater is not a very vascular part; it is principally supplied by a branch from the internal maxillary, called spheno-spinal, which, after passing through the spinous foramen, ramifies on the sides of the membrane. It is likewise supplied by branches from the internal carotid and the vertebral. The vessels most manifest on the exterior of the membrane are the veins, which are placed external to the arteries, accompanying the arteries, and terminating, some in the nearest sinuses, and others, after passing through perforations in the cranium, in the internal and external jugular veins.]*

There are small rounded bodies of a reddish colour and fleshy texture met with in different parts of the membrane, called *glandulæ Pacchioni;* some of these are situated near to the falx, others in the longitudinal sinus, and some between the fibres of the dura mater at different parts.

PROCESSES OF THE DURA MATER. The dura mater sends in processes between the different parts of the brain. They are;—

1. FALX MAJOR (falciform process). So called from being like a sickle, or septum cerebri, from its separating the two hemispheres of the cerebrum. Is formed by a doubling of the dura mater. It begins from the crista galli and middle of the sphenoid bone; is continued directly backwards as far as the protuberance of the os occipitis. It is attached in its course to the bones above-mentioned, to the spine of the os frontis, to the junction of the ossa parietalia, and behind to the upper half of the perpendicular ridge of the os occipitis. It is at first narrow, but gradually becomes broader as it extends backwards; and terminates at the transverse ridge of the os occipitis by dividing into the layers, which form the tentorium.

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* A more minute account of the anatomy of the brain has been here given than is necessary for the beginner, and he may omit in the present dissection, or defer, the parts between crotchets, *[ ].

2. TENTORIUM CEREBELLI (transverse septum, lateral processes). *[Is formed by the division of the falx, and by two layers from below, thus constituting a double layer of dura mater. It is continued horizontally over the upper part of the cerebellum. It is severally attached to the transverse ridges of the occipital bone, to the edges of the petrous portions of the temporal bone, and to the posterior clinoid processes of the sphenoid bone. In the midst, behind the sphenoid bone and between the two processes, is a large opening of communication, through which passes the isthmus of the brain, or that process by which cerebrum and cerebellum are united. The processes, though *called* transverse, give a tense covering to the cerebellum rather in the form of an arch or vault, which is supposed to defend it from the pressure of the cerebrum superincumbent.]*

3. FALX MINOR (septum cerebelli). *[Is placed between the lobes of the cerebellum. It commences from the tentorium, opposite the greater falx, passes down to the foramen magnum, is of inconsiderable breadth, and diminishing as it descends, terminates at the edge of that opening. It adheres to the lower part of the perpendicular ridge of the os occipitis. The tentorium and falx minor cannot be examined during this stage of the dissection.]*

SINUSES OF THE BRAIN.

The principal vessels which return the blood from the brain, are formed by the dura mater, and are called *Sinuses.* They differ from the veins in structure and in figure; their shape is triangular; they have no valves, and do not accompany the arteries. There are four principal sinuses.

1. SUPERIOR LONGITUDINAL SINUS (falciform). This may now be examined, by cutting through the dura mater which forms its upper wall. It begins at the crista galli, passes directly backwards, is placed in the upper part of the falx major, being situated under the sagittal suture, and terminates opposite the protuberance of the os occipitis. It is narrow in its commencement, becomes more capacious in its course backwards, and terminates in the lateral sinuses, most commonly in the right. On laying open the *longitudinal sinus,* its figure and structure will be better seen. Within it, will be seen the openings of the veins, the greater number of these take their course and enter the sinus obliquely from behind to before. Near the orifices of the veins are numerous tendinous fibres, called the *chordæ*

Willisii. There are likewise commonly found a number of those small bodies before described as the *glandulæ Pacchioni.*

The other sinuses are here enumerated, but cannot well be seen at this time.

2. Lateral Sinuses, two in number. * [Begin at the termination of the longitudinal sinus, pass outwards on each side in the grooves of the transverse ridges of the os occipitis, are continued in the sulci of the temporal and occipital bones, at first outwards, then downwards, and terminate at the base of the cranium, in the internal jugular veins, at the foramina lacera basis cranii, where those veins begin.] *

4. Torcular Herophili (fourth sinus). *[Obtained this name from the exploded notion that the blood is squeezed as in a *torcular* or wine-press. It is formed by the vena magna galeni (afterward to be shewn); it passes backward between the falx and tentorium; and, descending a little, terminates, most commonly, in the left lateral sinus.]*

These are the four which are important with respect to size and function. *[The others have been thus enumerated:—1. *Inferior longitudinal sinus.* Situated at the under-edge of the falx; of small size, round, receives veins from the adjacent parts, and terminates in the torcular Herophili.—2. *Circular sinus* (of Ridley). Placed about the pituitory gland, terminates in the cavernous sinus.—3. *Cavernous sinuses.* Situated at the sides of the sella turcica, receive branches from the adjacent parts and ocular veins, surround the carotid arteries, appear cellular, and communicate with the superior and inferior petrosal sinuses.—4. *Superior petrosal sinuses.* Situated on the ridges of the petrous portions of the temporal bone, receive blood from the cavernous sinuses and adjacent parts, and terminate in the lateral sinuses.—5. *Inferior petrosal sinuses.* Situated at the roots of the petrous portions of the temporal bone, receive blood from the cavernous sinuses, and do not communicate with the lateral sinuses, but with the jugular veins.—6. *Occipital sinuses.* Situated near the foramen magnum, communicate with the inferior petrosal and lateral sinuses, and the vertebral veins. The sinuses communicate at many parts with veins which pass through the bones of the skull.]*

The dura mater is next to be raised in order to display the *tunica arachnoides.*

Tunica Arachnoides. Is exceedingly thin, and therefore not easily distinguished from the pia mater, which it covers; but if a small opening be made, and air blown into it, the membrane will be made apparent, and the air will be seen to insinuate itself through the reticular texture, which connects it with the pia mater. At the base of the brain, as may be seen hereafter, it is much more distinct, being less connected with the pia mater. It is very tender in its texture, has a whitish appearance, but is nearly transparent, It covers the whole surface of the brain, (and is continued with the medulla oblongata and spinal marrow) but does not extend *round* the surface of each convolution, being spread from the one to the other: it is most distinct above the interstices of the convolutions. It forms a smooth and polished surface, where it is in contact with that of the dura mater.

PIA MATER. Is the third and close covering to the brain, situated immediately under the arachnoid membrane. It is extended not only over the whole surface of the brain, entering also into its larger divisions, but dips in between the convolutions, quitting the tunica arachnoides, and envelopes each eminence and depression of its surface. It is also continued into the interior of the brain, in order to line its different cavities. Its texture is tender. It varies in thickness and consistence at different parts. When raised from the brain, its surface has a flocculent appearance, from the fine vessels which pass from the membrane into its substance; and, when the membrane has been injected, it appears to consist almost entirely of blood-vessels. The larger branches, derived from the base of the brain, take their course through the pia mater, ramify and divide minutely, so as to form an intricate network of vessels from which minute branches only penetrate the substance of the brain. The pia mater is made up of the ramification of vessels, united by a fine reticular texture. We now proceed to the brain itself, properly so called.

OF THE BRAIN.

This term includes three different parts, into which the mass is divided, viz. 1. Cerebrum. 2. Cerebellum. 3. Medulla Oblongata. Some have comprehended also under the general term a fourth part, namely, Medulla Spinalis.

CEREBRUM. Is the largest of the divisions. It is situated in, and fills up the upper part of the cranium. Is of an oval rounded figure, and divided by a middle longitudinal section (fissura longitudinalis) into two equal and similar halves, called its *hemispheres*. Their upper and outer surface is rounded, their inner surfaces, which are in apposition to each other, are flattened, and the lower surface is divided in each into three lobes.

The surface of the hemispheres, more especially at the outer and upper part, is irregular, divided into a number of turning or winding eminences, called *convolutions* (gyri) with corresponding depressions between them, called *sulci*. They run in various directions; their breadth, length, and depth vary on the same side, and do not correspond on the opposite sides.

Corpus Callosum (commissura cerebri magna). On separating the hemispheres is seen a transverse oblong portion of medullary matter, connecting the two hemispheres, situated nearer their anterior than posterior extremities. This is the *corpus callosum*. It is about three inches long, is narrower before than behind, and is continued on each side into the substance of the hemispheres. Along the middle of its upper surface runs, from before to behind, a line formed by a slight depression between two inconsiderable ridges, called the *raphe*: from each side of the raphe there issue transverse striæ, which are continued into the hemispheres. The posterior extremity of the corpus callosum presents a rounded transverse eminence, which renders this extremity thicker than the other. *[When the dissection has been further prosecuted, it may be seen that the anterior extremity does not terminate, as it appears to do, between the hemispheres, but is turned downwards, so as to form a concavity towards the ventricles, is stretched over the fore part of the corpora striata, and thus incloses the ventricles anteriorly; it terminates by a layer, which is extended backwards between the hemispheres, and forms the parietes of the ventricles inferiorly; this becomes narrow pointed, and reaches to the crura of the fornix. Between these layers the septum of the ventricles is stretched perpendicularly.]*

The upper surface of the corpus callosum is best seen after the upper part of the hemispheres has been cut down to a level with it. In making the section the knife should be carried from its surface a little upwards, as well as outwards, throughout the hemispheres. The surfaces produced by this section present the appearance which is called the *centrum ovale*; the section likewise shews the two substances of which the brain is principally composed. The darker substance on the outside is called the *cineritious*, from its greyish or ash colour, or *cortical*, from its surrounding, like a bark, the inner parts of the brain. The convolutions are seen each to receive a covering from a layer of the cineritious substance, which is not more than from 1 to 1½ line in thickness. The inner substance is called *medullary*, it is white in colour, and much more abundant.

The next part of the dissection consists in making a longitudinal cut on each side of the raphe, by which means the lateral ventricles will be laid open; these are cavities of considerable extent, which occupy the middle parts of the cerebrum.

The parts which come into view when the lateral ventricles have been opened, are the corpora striata, the thalami nervorum opticorum, the tænia semicircularis, and the plexus choroides. The ventricles are separated by means of a partition called the septum, or septum lucidum.

SEPTUM OF THE VENTRICLES. Is seen by gently raising the corpus callosum. Above it is connected to that body through its whole length; below it is united with the fornix, *[but only on the posterior part, for anteriorly, and beyond the separation of the crura, it is extended between the two layers of the corpus callosum.]* It is of a triangular figure, considerably deeper and thicker anteriorly, and gradually tapering hindwards. It is composed of two distinct medullary layers, and these are lined by a delicate membrane, particularly distinct in cases of accumulations of fluid. The space which is thus left between the two layers is called the *ventricle of the septum* (fossa Sylvii, fifth ventricle) but it is nothing more than a fissure; it varies somewhat in form and size. It has not been yet decided whether it communicates with the other ventricles.

CORPORA STRIATA. Are two pyriform bodies of cineritious colour, one situated in each ventricle. They are placed obliquely, their narrow extremities being situated backwards, and on the outer side of the thalami nervorum opticorum; their anterior, or larger extremities, placed forwards.

THALAMI NERVORUM OPTICORUM. Are two bodies of a white colour from the medullary structure of their exterior. They are situated behind the corpora striata, and to their inner side. They appear of a rounded figure, are larger behind than before, anteriorly they are lengthened, become narrower, and converge.

TÆNIA SEMICIRCULARIS. In the groove between the corpora striata and thalami a *medullary band,* so called, is seen on each side.

PLEXUS CHOROIDES. Is a vascular fold of pia mater, partly covering the thalami nervorum opticorum, and continued backwards upon them. Its extent will be afterwards traced. On raising it, the thalami and the tænia semicircularis will be seen more distinctly.

LATERAL VENTRICLES (magni, tricornes). Are situated on each side by the side of the corpus callosum, fornix, and septum; their figure is irregular, but lengthened from behind to before. The centrum ovale is said to form their roof: a middle part and three cornua or horns are distinguished in each. The middle part passes from behind to before, is bounded on the inner side by the septum and corpus callosum, on the outer by the corpus striatum: its floor is formed by the fornix.

1. ANTERIOR CORNU. Is the smallest; is turned outward and downwards, and lies between the anterior boundary of the cavity, and the fore part of the corpus striatum.

2. POSTERIOR CORNU. Is continued from the hinder extremity of the middle part; called also *fovea digitata.* It is about an inch in length, but in this it varies. It is turned backwards with a slight bend only outwards, gradually narrowing and ending in a blunt extremity. Its inner wall forms a considerable projection, called *eminentia digitalis* (calcar, unguis, pes hippocampi minor) which is very rarely found wanting; but varies considerably in size and form. It is medullary without, and cineritious within.

3. DESCENDING CORNU. Is the largest. It passes downwards, then forwards and inwards, forming a considerable bend, of which the concavity is inwards, the convexity outwards along the crus cerebri, and occupies the under, inner, and fore part of the middle lobe; it terminates at about half an inch distance from its extremity.

PARTS SEEN IN THE DESCENDING CORNU. On its under surface run two considerable projections, the cornu Ammonis and tænia hippocampi. The *plexus choroides,* after extending through the middle part of the lateral ventricle, and becoming gradually broader, descends through the inferior cornu upon the tænia and cornu Ammonis. The *cornu Ammonis* (cornu arietis, pes hippocampi) runs along the *descending cornu,* and forms a bend like it, becoming, in its passage from behind to before, gradually broader and higher; it terminates by a broad extremity, which is turned inwards at the extremity of the *descending cornu,* and at this part has often four or five small indentures. Sometimes there is a second eminence running along it, *eminentia collateralis.* Along the inner concave edge of the cornu Ammonis runs a narrow, medullary, sickle-shaped band, called *tænia* or *fimbria hippocampi,* with a sharp inner edge, upon which the plexus lies. It is the continuation of the posterior crus of the fornix; it terminates about half an inch sooner than the cornu Ammonis, imperceptibly in a convolution. By the side of the tænia, but somewhat covered by it, more backwards and inwards, runs a similar cineritious projection, with numerous notches, called the corpus fimbriatum, or *fascia dentata*. *[A section of the cornu Ammonis shews its structure. Its surface is formed of a layer of medullary matter which is continuous on the inside with the tænia hippocampi, and both are connected above, with the substance of the fornix and corpus callosum. Under it is a layer of cineritious substance, beginning at the indented band (fascia dentata). In the doubling of this last stratum is a second thinner layer of medullary substance.

The lateral ventricles are formed by continuous brain-substance, except where bounded by the fornix and its crura (fimbriæ) which are not continuous with their walls; so that when the pia mater and tunica arachnoides have been removed, a passage is formed, without cutting, from the lateral into the third ventricle, and from the inferior cornu to the exterior of the brain.]* The fornix may now be examined.

Fornix. It is situated beneath the septum, and forms a vaulted covering to the third ventricle, from which it has received its name. Above and behind it is continuous with the corpus callosum; before, and in the greater part of its length, with the septum lucidum. The upper border is convex, the under concave; the latter lies upon, and covers for the most part, the thalami, and is continued downwards and forwards. The whole of the middle part, which is flattened from above to below, is called *the body*. Under the anterior part of the fornix, between the extremities of the thalami, is situated a small opening, called the *foramen Monroi*, and when the membranes have been removed is of large size; it forms a communication between the third and lateral ventricles. The existence of this foramen has been denied by some anatomists, chiefly from the circumstance that fluid sometimes collects on one side only; which, however, may be owing to unnatural adhesions, or in consequence of the plexus choroides, which begins at this part, filling up the opening.

The fornix may now be divided transversely near its middle, and the divided portions reflected. This will display the third ventricle, and the *vena magna Galeni*, a considerable vein, will be seen taking its course immediately under it, from before to behind. It will be seen likewise that the fornix is striated on the under surface posteriorly. This appearance is called *lyra* or *psalterium*. The fore part of the fornix is turned downwards, becomes cylindrical, is continued towards the bottom of the third ventricle, behind the anterior commissure, and divides into two diverging cords called the *anterior pillars* (crura fornicis anteriora). Between these the anterior commissure is seen. * [The anterior crura pass on each side, under the thalami, covered with cineritious substance, immediately over the union of the optic nerves, to which sometimes distinct filaments may be traced. They then form an arch bent outwards, and terminate in the cineritious substance of the eminentiæ mamillares, processes which were hence called by Santorini, bulbi fornicis.] * The fornix terminates behind in two flattened bands, called the *posterior crura,* which diverge from each other, and descend into the inferior cornua of the lateral ventricles.

THIRD VENTRICLE (processus fissuræ medianæ perpendicularis). Situated between the thalami nervorum opticorum. It is a fissure only, but of considerable extent from before to behind. It is of irregular figure, but deeper before than behind. * [The floor is formed by the cineritious substance anteriorly to the crura cerebri, by the eminentiæ mammillares, and by the infundibulum, into which it is continued. Its anterior surface is formed by a thin cineritious lamina, the anterior pillars of the fornix, and the anterior commissure; its roof, by the body and posterior pillars of the fornix, and the posterior bend of the corpus callosum; its sides, by the thalami nervorum opticorum. It is divided into an upper and lower part by the commissura mollis.] * Anteriorly it leads to the infundibulum; whence the passage is called *iter ad infundibulum.* At its posterior part is an opening which is the entrance of a passage called the *iter a tertio ad quartum ventriculum,* from its forming a communication with the ventricle of the cerebellum. In the third ventricle are seen likewise three processes called commissures.

1. COMMISSURA MOLLIS. Is a process of soft cineritious substance, which passes across the ventricle, and connects the thalami nervorum opticorum.

2. COMMISSURA ANTERIOR (magna) Is a bundle of medullary substance, of a rounded figure, somewhat flattened from above to below, covered by membrane. It is situated immediately before the anterior pillars of the fornix, at which part its middle is seen to lie straight across; * [but it is then continued into the fore and under part of the corpora striata, and in its passage spreads and becomes thinner, forms an arch, of which the convexity is forwards, and passing through the corpora striata without mixing with its substance, spreads in a radiated manner.] *

3. Commissura Posterior. Is a small transverse band of medullary substance at the upper and back part of the third ventricle, above the iter a tertio ad quartum ventriculum.

*[Thalami Nervorum Opticorum (ganglia postica, corpora striata posteriora, colliculi). Are on their exterior white from the medullary structure at this part. Seen in the lateral and third ventricle, and on the exterior of the brain. They are of a rounded figure, larger behind than before; anteriorly they are lengthened, become narrower, and converge. They are placed before the corpora quadrigemina, and surround the crura cerebri. On the outer side they are united by a continuation of medullary substance with the hemispheres, and with the corpora striata. The upper surface is rounded, seen in the lateral ventricles. The inner surface is seen in the third ventricle; on it is a medullary ridge, or line, formed by the elongation of the peduncle of the pineal gland. Below this the thalami are flattened, greyer, and contiguous. Behind they are unconnected, but before are united by the commissura mollis; which is occasionally wanting, and sometimes double. Below, the thalami are mediately united by the paries of the third ventricle. The posterior surface is also rounded, and divided into three eminences: the posterior and largest is called tuberculum posterius. The other two, situated anterior to it, are distinguished by the names externum and internum (tubercula inferiora, corpora geniculata). The two inferior are connected, by medullary bands, with the corpora quadrigemina; they are externally medullary, internally of medullary and cineritious substance mixed; inferiorly they are continued into the roots of the optic nerves. The thalami inferiorly having been continued around the crura, form the tractus opticus, which terminates at the union of the optic nerves.

The upper and posterior surface of the thalami is covered by a thin layer of medullary substance: the inner surface is cineritious. It is internally made up of medullary and cineritious substance mixed, being composed of layers, the rays of which run from within to without, and become interwoven with the substance of the crura cerebri.

* 3. Corpora Striata (ganglia antica). Occupy the greater part of the lateral ventricles, and under part of the anterior lobes. A considerable part of their upper and inner circumference is seen, forming the floor of the anterior cornu of the lateral ventricles, being broad before and narrowing hindward, and becoming arched. From the outer edge the medullary substance passes perpendicularly upwards, to form the side and upper part of the lateral ventricle.

* The corpora striata are made up of alternate layers of medullary and grey substance, which are bent upwards in the same direction as the surfaces.

*4. TÆNIA SEMICIRCULARIS (striata, stria cornea, geminum centrum semicirculare). In the groove between the corpora striata and the thalami there is a medullary band on each side, of small size. It begins near the foramen Monroi, where it is connected with the anterior pillar of the fornix. After having passed around the corpus striatum, it is continued along the roof of the inferior cornu of the lateral ventricles, and is lost towards its extremity.

* Posteriorly and superiorly from the third ventricle there is a considerable opening, naturally shut by the pia mater and tunica arachnoides, which is continued under the posterior extremity of the corpus callosum, and above and before the pineal gland, upon the exterior surface of the brain.

* PIA MATER OF THE VENTRICLES. It begins at the opening which has just been noticed; is broad in the middle and folded at the sides. It is here continued from the pia mater of the exterior, which covers the adjacent parts, envelopes the pineal gland, and is folded into this much narrower compass. It is extended forwards, under the posterior edge of the corpus callosum, its upper and under surfaces adhering together.

* From the vessels of the ventricles, the blood is returned by the *veins of Galen*. The delicate venous vessels of the choroid plexus unite successively with each other, in order to form two trunks so called. The Galenian veins, formed near the anterior pillars of the fornix, run backwards under the fornix, covered by the pia mater and tunica arachnoides, and towards their extremity receive usually the veins of the cerebellum, terminating sometimes separately, more commonly by means of a common trunk, in the torcular Herophili.] *

PARTS BETWEEN THE HEMISPHERES POSTERIORLY. These are the Corpora Quadrigemina and Pineal Gland.

CORPORA QUADRIGEMINA (bigemina, nates et testes). Consist of four rounded projections, separated by a cruciform furrow. The upper and anterior which are the larger, are called *nates:* the lower and posterior, *testes*. They are situated between the posterior extremities of the thalami, below the pineal gland, anterior to the cerebellum, and above the crura cerebri. They are internally composed of cineritious substance (rather reddish), which is surrounded by a thin layer of medullary matter, through which the cineritious appears.

PINEAL GLAND (conarium). Is a small body, ovoid, placed upon the corpora quadrigemina, and of a dark cineritious colour. It is connected by means of two peduncles with the thalami, being placed between their posterior extremities, but at a little distance from them. The *peduncles* are two narrow medullary bands, which are continued distinct upon the inner surface of the thalami, till they are lost upon it near the anterior pillars of the fornix.

From its base is continued a lamina of medullary matter, which turns forwards, and is continued with the substance which connects the nates, and has been already mentioned as the *posterior small commissure.* The pineal gland is firmer in texture than cineritious substance generally. Within it, but not always precisely in the same place, is found a yellow hard semitransparent substance made up of rounded grains, called by Soemmering *acervulus cerebri.* It is said to be found in subjects from six years of age upwards; to be of the same composition as the earth of bones; its quantity least in young subjects and in age; and not at all connected with disease of the brain. On the contrary, Wenzel observes, that in four cases of insanity its quantity was very small.

After the posterior parts of the cerebrum have been examined, the brain may be removed from the cranium. For this purpose the tentorium should be cut through, and the medulla spinalis divided as low as the knife can be insinuated. The brain is then to be cautiously raised from before hindwards, and in so doing the nerves which arise from it, and which deserve to be noticed, will present themselves in the following order:—1. Olfactory. 2. Optic. 3. Common oculo-muscular, or motores oculorum. 4. Inner oculo-muscular, or pathetici. 5. Trigeminal. 6. Outer oculo-muscular, or abducentes. 7. The Auditory and the Facial. 8. The Pneumo-gastric or Par Vagum, and the Glosso-pharyngeal. 9. Lingual. Their origin cannot be traced till the brain has been removed.

The brain may now be cautiously raised in order to examine the inferior surface of the cerebrum, cerebellum, and medulla oblongata.

INFERIOR SURFACE OF THE CEREBRUM. In order to examine the base of the brain, the pia mater should be carefully dissected from it. At the sides each hemisphere is seen to be divided into three lobes (some reckon two): an *anterior*—a *mid-*

dle, divided from the anterior by the fossa Sylvii—and a *posterior,* resting upon the tentorium. In the middle are:—

CRURA CEREBRI. Are situated immediately before the pons Varolii. Are two bodies, externally medullary, of a rounded figure, diverging and enlarging as they extend forwards. Below, are separated by a fossa of some depth and breadth. This Fossa forms the floor of the aquæductus Sylvii. Its under surface is cineritious and perforated by numerous vessels, and hence called *substantia perforata.* The crura are covered anteriorly by the junction of the optic nerves, posteriorly by the pons Varolii. The crura are composed externally of a layer of medullary matter, under which is a layer of *dark* substance, called the *locus niger.* [illegible]

Between the crura on the fore part is a triangular portion of cineritious substance, which widens anteriorly, and forms the floor to the third ventricle. It contains the eminentiæ mammillares, infundibulum, pituitary gland, and the origin and junction of the optic nerves.

EMINENTIÆ MAMMILLARES (medullares, candicantes, albicantes). Are two small rounded conoid bodies, situated close together between the crura. They are externally medullary, and internally cineritious. They form the extremities of the anterior pillars of the fornix.

[illegible]

INFUNDIBULUM AND PITUITARY GLAND. The *infundibulum* is, as the name expresses, a narrow funnel-shaped body, which extends from before the corpora albicantia downwards and forwards, and terminates in the glandula pituitaria: so called, but the glandular nature of which is at least problematical. This is placed in the sella turcica, and covered by the dura mater, through an opening in which the infundibulum becomes connected with it. The infundibulum is somewhat narrowed in the middle, and is composed of cineritious substance. It is not always distinctly hollow; but air may be blown from the pituitary gland into the third ventricle, but not always in the contrary direction. The pituitary gland is an oval, having its long axis from side to side; it consists of an anterior and posterior lobe. It is firm in texture. In this gland likewise a gritty matter is sometimes found.

Anteriorly to the infundibulum and pituitary gland are the *optic nerves,* the roots of which extend over the crura and bottom of the third ventricle, from which they receive filaments, and become united at this part.

The rest of the under surface does not present any remarkable appearance. The surface of the lobes have the same structure externally as that of the cerebrum in general.

CEREBELLUM.

The cerebellum is less than one third of the volume of the cerebrum. It is situated in the fossæ of the occipital bone, under the posterior lobes of the cerebrum, and separated from them by the tentorium. It may be divided into its body and crura: the body again into middle and sides.

The *body* of the cerebellum is of a rounded figure, having its greatest breadth from side to side; its depth is greatest in the middle, but it decreases in thickness to the edges.

Its surface is cineritious, and like that of the cerebrum rendered unequal by convolutions and corresponding furrows, which are covered by the same membranes as the cerebrum. The convolutions are the upper edges of laminæ: these are more regularly disposed, and narrower than those of the cerebrum; they have a concentric arrangement, the posterior convolutions being the longest, with their convexities facing outwards, their concavities inward. These convolutions, or laminæ, are variously divided and fitted into each other.

Their larger divisions have been called *lobes*, and have received distinguishing names. These lobes are again divided into secondary portions, or lobuli.

SURFACES. The superior surface presents, in the middle, a longitudinal eminence, transversely furrowed, termed the *processus vermiformis superior*. The sides form two nearly plane surfaces, which have a slight inclination outwards and downwards.

The inferior surface has in its middle a deep depression, which lodges the beginning of the medulla oblongata. On separating the hemispheres, there will be seen between them a longitudinal eminence, of a cineritious colour, larger behind than before, furrowed transversely, and named *processus vermiformis inferior*. The extremities of these processes are nearly in contact, and separated only by the point of the fourth ventricle.

The superior vermiform process is continued anteriorly into the *valvula cerebri*, or velum Vieussenii. This is a thin lamina, which lies over the under end of the aquæductus Sylvii and over the upper part of the fourth ventricle. It ascends and becomes connected at the sides with the inner surface of the crura cerebelli, as far as the corpora quadrigemina. In its ascent it becomes narrower and thinner, and terminates in an arched edge. Its under surface is smooth, its upper surface divided by a longitudinal furrow, and posteriorly by transverse furrows.

At the sides of the velum are two medullary columns, extending from the testes to the cerebellum, called *processus ad testes*, or columnæ valvulæ.

CRURA CEREBELLI. Are two rounded medullary bodies, which extend between the pons Varolii on each side, and the sides of the cerebellum. These, it will be seen, are also connected by medullary bands, or columns, with the corpora quadrigemina above, and the medulla oblongata below.

FOURTH VENTRICLE, or ventricle of the cerebellum. This may be best displayed by a longitudinal incision from above downwards. It is of a triangular figure, of which the base is placed anteriorly, and the apex in the opposite direction. The base is continued without interruption into the calamus scriptorius (p. ~~86~~ 98) of the medulla oblongata, and *(anteriorly)* under the corpora into the aquæduct: It is formed by the pons Varolii; and there is a longitudinal depression in its middle. The sides are formed by the processus vermiformes, the velum, and the crura of the cerebellum. Behind, it is open: and here the internal surface of the cerebellum is continued onwards to the exterior, between the cerebellum and medulla oblongata.

The *aquæductus Sylvii* (canalis eminentiæ quadrig.) which may most conveniently be here described, is a narrow canal of communication between the ventricles of the cerebellum and cerebrum, which is continued downward and backward under the corpora quadrigemina, the opening of which is seen, as has been before described, in the third ventricle.

DISPOSITION OF MEDULLARY AND CORTICAL SUBSTANCE IN THE CEREBELLUM. On the exterior it is every where composed of cineritious substance. Its interior surface seen in the fourth ventricle consists of medullary substance, which, continuing anteriorly to the corpora quadrigemina, posteriorly to the medulla oblongata, inferiorly and laterally to the pons Varolii, spreads itself in the interior in an arborescent manner.

This distribution may be seen by perpendicular sections, and the appearance, which is thus produced, is called the *arbor vitæ*. When cut in slices, nearly parallel to the base of the brain, the medullary substance appears in laminæ, corresponding to those of the surface of the cerebellum. In the middle of the medullary substance of each hemisphere, placed rather inwards, is a long, rounded, firm, vascular body, internally medullary, surrounded by a cineritious border, which has numerous forked projections: it is called the *corpus rhomboideum* (fimbriatum, dentatum).

* [The medullary substance of the cerebellum, which forms in its continuation the crura, appears as three indistinctly separated columns, which have themselves, by some anatomists, been called *crura*, and designated as:—1. Crus cerebelli ad medullam oblongatam (descendens) which is continued with the posterior column of the spinal marrow.—2. Crus cerebelli ad eminentiam quadrigeminam (ascendens) which is continued to the testes.—3. Crus cerebelli ad pontem, which is continued with the pons Varolii.] *

PONS VAROLII (nodus cerebri, protuberantia annularis, commissura cerebelli). Is a considerable arched eminence, oblong from side to side, situated at the under surface of the brain, projecting over the base of the medulla oblongata and crura cerebri, from both of which it is distinctly separated.

The pons Varolii is the firmest part of the brain and spinal marrow. Its structure is complex: it is principally made up of transverse fibres, of a white colour, bent forwards, within which there is cineritious substance, mixed with numerous thin medullary layers.

MEDULLA OBLONGATA (bulbus medullaris, &c.). Is the hindmost and undermost part of the brain, extending from the middle of the cuneiform process to the first vertebra, where it terminates continuously in the medulla spinalis. It is about an inch in length, of a rounded figure, and expanded above.

The anterior surface is divided into a right and left half by a longitudinal furrow, which is continued from the spinal marrow. It has two pair of eminences: the corpora pyramidalia and olivaria.

CORPORA PYRAMIDALIA. Are a continuation of the decussation of the anterior columns of the spinal marrow, from which they arise. Are situated on the inner side, and are in contact with each other. They reach through the length of the medulla oblongata, are broader and more prominent above, and become gradually narrower below. They leave between them, superiorly, a small fissure, into which the pia mater penetrates: and are composed entirely of medullary matter.

CORPORA OLIVARIA (ovalia, lateralia). Are situated to the outer side of the pyramidalia, and form an oval prominence on each side, a little below the pons. They are externally medullary; but contain within a nucleus of medullary matter, surrounded by cineritious substance of a firm texture and unequal surface, named *Corpus olivæ fimbriatum.* The medullary matter is continued with the pyramid, the cineritious with that of the spinal marrow.

The posterior surface of the medullary oblongata is hollowed, and forms a triangular depression, of which the apex is downwards, and terminates in the spinal marrow; it is called the *calamus scriptorius.*

At the upper part of the posterior surface are *several slightly prominent medullary stripes,* which run from the middle depression outwards. They sometimes, though rarely, are found wanting on one or both sides; and vary considerably in number, size, length, and course. They generally extend to the auditory nerve, of which they form the roots; and are sometimes connected with the par trigeminum and par vagum.

ORIGIN OF THE CEREBRAL NERVES.

The number of these nerves has been variously estimated from different views of the division of the brain, and from considering some nerves now as separate, now as parts of others. There may be said to be eleven pair. 1. *Olfactory.*—2. *Optic.* —3. *Common oculo-muscular,* or *Motores oculorum.*—4. *Inner oculo-muscular,* or *Pathetici.*—5. *Trigeminal.*—6. *Outer oculo-muscular,* or *abducentes.*—7. *Auditory.*—8. *Facial.*—9. *Glosso-pharyngeal.*—10. *Pneumo-gastric,* or *par vagum.*—11. *Lingual.*

1. OLFACTORY (nerv. olfactorius, par primum). Is situated in a groove on the anterior lobes, near to their inner edge. It arises by three roots of medullary matter from the inner and back part of the under surface of the anterior lobe, where it joins with the middle lobe. The nerve runs forward, over the sphenoid bone and cribriform plate of the ethmoid bone, inclined to the opposite nerve. It gradually enlarges and forms a bulbous extremity (bulbus nervi olfactorii) from which nerves go to the nose. It is composed of medullary and cineritious fibres intermixed.

2. OPTIC (nerv. opticus, par secundum). Arises by a broad flat beginning from the back part of the outer and upper surface of the thalamus and corpora quadrigemina, being connected more especially with the testes. The nerve is continued forwards and inwards over the inferior surface of the crus cerebri to which it is attached; it becomes in its course narrower, thicker and rounder; and joins with the other optic nerve, at an obtuse angle immediately under the third ventricle, with the bottom of which it is connected by fibres. The optic nerves from their origin to this part form the *tractus opticus.* The

nerves then separate and diverge to pass through the optic foramina. * [Concerning the manner of their junction there still subsists a variety of opinion: viz. 1. That they are only contiguous; 2. Or that they compleatly cross, a decussation taking place, so that the right passes to the left, the left to the right side; 3. Or that the decussation is only partial. The first opinion is supported by the fact that the outer fibres have been found to pass on to the same side, and that no decussating fibres can be discovered in the middle; that two cases have been met with, in which no union was traced; and that in blindness with consequent decrease of the nerve, the diminution has been continued behind the place of junction on the same side. The second opinion is supported by the alleged observation of several anatomists; by cases where a small optic nerve, without disease beyond the place of junction, has re-appeared as a small nerve behind the place of junction on the opposite side; by cases of disease where the opposite nerve has been affected behind the junction; by some cases where the disease has been at the origin of one nerve, and the opposite eye affected; and by analogy with the optic nerves of fish, in which a compleat decussation is evident. Nor is the third opinion unsupported by anatomical examination and by pathological observations, in which the affection has been continued on the same side through the external fibres, to the opposite side by the internal fibres, or where in the affection of one eye and nerve, both nerves have been affected behind the place of junction. The necessary inference from these observations, supposing them correct, is that the junction is taking place in different individuals in the three different modes above enumerated. But it is probable that in the greater number of instances the mixture of fibres is more or less partial. At the same time it may be remarked that the decrease of the nerve behind the place of junction cannot amount to a proof; as where blindness has continued for a length of time in both eyes, one nerve has been found much smaller than the other.]*

3. COMMON OCULO-MUSCULAR (nerv. oculo-muscularis communis, motor oculi, par tertium). Comes off close to the anterior edge of the pons varolii, from the inner surface of the crus cerebri. But its origin may be traced higher through the cineritious substance by a fasciculus, the anterior part of which reaches to the depression between the crura; the posterior to the bottom of the aqueduct. It is continued through the outer wall of the cavernous sinus, first above and then under the ophthalmic branches of the trigeminal nerve, and passes through the foramen lacerum orbitale.

4. INNER OCULO-MUSCULAR (nerv. oculo-muscularis internus, superior, patheticus, par quartum). Is the smallest of the cerebral nerves. It arises immediately behind the testes from the processus ad testes. The nerve then proceeds downwards and forwards, over the crus cerebelli before the edge of the pons Varolii, over the crus cerebri, is continued along the under surface of the brain, passes near the posterior clinoid process into a sheath of dura mater by which it is separated from the cavernous sinus, communicates by one thread with the first branch of the fifth, under which and the motor oculi it is placed, and then passes over the former and through the foramen lacerum.

5. TRIGEMINAL (nerv. trigeminus, par quintum). It makes its appearance between the pons Varolii and crus cerebelli. It may be traced toward its source from the part where it makes its appearance through the crus cerebelli upwards and backwards, to the depression between it and the corpus olivare, and takes its origin from both of these. In the first part of its course the fibres are not distinct, and it is surrounded by cineritious substance. It gradually enlarges at the part where it appears at the base; is flattened, but becomes rounder and smaller; then spreads in passing to the edge of the petrous portion of the temporal bone, along which it is continued forwards in a sheath of dura mater which separates it from the cavernous sinus. Upon the anterior part of its surface it is enlarged, and forms the *semilunar ganglion,* which for the most is of a homogeneous structure, like the ganglia, having its convex anteriorly and inferiorly, where becoming again fibrous, it passes off in three principal branches. 1. The *ophthalmic* or superior branch, the smallest, is continued along the outer side of the cavernous sinus to the orbit through the foramen lacerum. 2. The *superior maxillary,* the middle in size and situation, passes forwards to the foramen rotundum. 3. The *inferior maxillary,* the largest, from the lower and back part, passes downwards and outwards to the foramen ovale.

6. EXTERNAL OCULO-MUSCULAR (oculo-muscularis externus, abducens, par sextum). It arises from the upper end of the corpus pyramidale and posterior edge of the pons Varolii. It sometimes arises alone from the corpus pyramidale or olivare. It passes outwards and forwards, and takes its course opposite to the posterior clinoid process through the dura mater into the cavernous sinus, from the blood in which it is separated by the internal membrane. It lies on the outer side of the carotid artery with which it is connected, and sends

some filaments to the sympathetic nerve, and then is continued through the foramen lacerum.

7. FACIAL (portio dura, communicans faciei, sympatheticus minor). Is smaller than the portio mollis, arises from the portio mollis, which receives it in a groove, from the posterior edge of the pons Varolii and from the crus cerebelli. The nerve passes from the side of the middle of the pons forwards and outwards to the auditory foramen, is continued through its canal with the portio mollis, then quits it and takes its course through the canal of Fallopius.

8. AUDITORY (Portio mollis, auditorius, acusticus, par septimum.) Is so named from its soft texture, but is more firm than the olfactory. Arises by the white filaments of the calamus scriptorius, and from the lateral surface of the crus of the cerebellum, just above the nervus vagus. It passes over the edge of the crus cerebelli, with which it is intimately connected. Its inner surface is hollowed for the reception of the portio dura. At its origin it is soft and not distinctly fibrous; but becomes so on leaving the brain. The nerve passes into the meatus auditorius internus, along which it is continued.

9. GLOSSO-PHARYNGEAL (nerv. glosso-pharyngeus.) Arises by five or six threads between the nervus vagus and facial nerve, close to the former, from the under surface of the crus cerebelli, from the depression between it, the corpus olivare, and the posterior edge of the pons Varolii, from which it receives sometimes a filament or two; takes its course outward, and at first forward, and is connected by a strong branch with the pneumo-gastric nerve. It passes into a separate sheath of dura mater, and is continued through the fore part of the foramen lacerum basis cranii, at the beginning of which it forms an oval ganglion.

10. PNEUMO-GASTRIC (nerv. vagus, nerv. pneumogastricus, &c.) Arises from the under and lateral part of the crus cerebelli, and from the groove between it and the corpus olivare, by from ten to sixteen filaments, receiving some few from the corpus olivare. These filaments converge into a flat trunk, which takes its course in a short sheath of dura mater through the fore part of the foramen lacerum, separated by a long process of bone from the internal jugular vein, and by dura mater from the nervus accessorius and nerv. glosso-pharyng. and in the canal it becomes rounded.

11. LINGUAL (nerv. lingualis, sublingualis, hypoglossus, &c.) Arises by four to eight filaments from the anterior surface of the medulla oblongata, and from the groove between the corpus olivare and corpus pyramidale. It forms two or three fasciculi which pass separately through the dura mater into the foramen condyloideum anterius, and are united at its outlet into a single trunk.

* [SPINAL MARROW.

The spinal marrow is enveloped by the same membranes as the brain.

DURA MATER. Forms a complete canal throughout the cavity of the vertebral column. It becomes gradually more capacious as it descends, and terminates at the under part of the sacrum in a cul de sac. The bag of the dura mater is smaller than the vertebral canal, especially laterally and posteriorly, and is at these parts attached to it by a loose cellular texture which contains, especially below, a considerable quantity of a reddish yellow fat-like substance; anteriorly it is closely connected with the vertebræ. It furnishes sheaths for the nerves, each sheath being continued with its nerve through its foramen, and is then gradually lost. Its fibres are more regularly arranged, but more delicate and less distinct than in the cranium.

PIA MATER. Is thick, of a close and firm texture, which increases downwards. It is closely adapted to the spinal marrow. It is yellowish white. Its external smooth surface is not connected with the tunica arachnoides. It terminates below in a single cord which passes between the nerves of the cauda equina, and is united below with the dura mater. It has an anterior and a posterior production or appendix, of which the former is the most distinct, which are continued into the corresponding fissures of the spinal marrow.

TUNICA ARACHNOIDES. Is disposed in the same way as in the cranium, and is loosely connected with the pia-matral covering.

LIGAMENTUM DENTICULATUM (serrated membrane). Is a narrow thin membrane, placed between the pia mater (of which it is considered by some anatomists as a process) and the tunica arachnoides on each side of the cord. Its inner border is straight and connected with the pia mater; its outer one presents a series of angular projections or teeth, about twenty in number, which are firmly attached to the dura mater; they are small dense strong cords, which pass in the spaces between the nerves. The membrane begins at the top of the cord and reaches to the extremity of the dorsal portion. It appears to have a tendinous structure. We now proceed to the spinal marrow itself.

SPINAL MARROW (chorda spinalis). Begins at the foramen magnum from the medulla oblongata. It is of a cylindrical figure. It may be divided into a cervical and dorsal portion. In its descent through the cervical vertebræ, it enlarges and again contracts, becoming as it enters the canal of the vertebræ dorsales somewhat smaller than above the enlargement. At the last dorsal vertebra it begins again to enlarge, but less considerably, and terminates in a blunt extremity, nearly opposite to the first lumbar vertebra, where it is divided into several cords. It is much smaller than the vertebral canal. It is divided into two lateral halves by an anterior and posterior fissure (fissura medullæ spinalis mediana anterior et posterior) which are extended along the whole anterior and posterior surfaces of the medullary substance. The anterior is the more considerable; but neither penetrate to the cineritious interior.

The spinal marrow is composed of cineritious and medullary substance. The cineritious situated within and the medullary without.

The spinal marrow is made up of two lateral double columns, which ascend parallel to each other, connected anteriorly and posteriorly by a lamina of medullary substance. The posterior columns continue their course: while the anterior decussate at the upper end of the spinal marrow, so that the right becomes left, and the left right. Here the anterior fissure is interrupted for about five lines. The decussation takes place by means of from three to five fasciculi, into which the anterior and posterior portions separate; whilst the lateral portions pass directly upwards.] *

*[NERVES OF THE SPINAL MARROW.

There are *thirty-one* pair, including the *accessory* and the *sub-occipital* nerves, which arise from the spinal marrow. They are divided into *cervical*, *dorsal*, *lumbar*, and *sacral*. They arise by a double root, an anterior and a posterior, from the corresponding surfaces of the medulla; the posterior roots are the larger, they arise nearer the middle, and are composed of fewer not so distinctly fibrous filaments as the anterior. The two sets of roots are separated by the ligamentum denticulatum; but unite at the part where the nerves pass through the dura mater.

Before this, their passage through the dura mater, filaments of communication may be seen between several of the pairs. Shortly after, the posterior root becomes enlarged in the form of a ganglion, with which the anterior does not communicate.]*

*[INTIMATE STRUCTURE OF THE BRAIN AND SPINAL CORD.

The substance of which the nervous system is composed appears to consist of *fibres,* though the evidence will vary with the methods of demonstration adopted. It is most manifest in the nerves; but likewise may be shewn in the brain and spinal marrow; although at the first sight indeed they appear only a soft, pulpy, and homogeneous mass. At some parts of the brain, more especially in those brains which are firm, a fibrous appearance is sufficiently distinct without artificial means, viz. at the corp. pyramidalia, crura, corpus callosum and other commissures and at the fornix. By some anatomists, as Haller and Soemmering, the fibrous structure has been admitted unconditionally in these parts alone. Others have even attributed the whole appearance to a coagulation at death. Malpighi was the first who shewed this disposition, and traced the fibres from the spinal marrow; but Gall, Reil, and Spurzheim, have more especially developed these opinions, and Reil particularly in regard to the spinal marrow. In the cortical substance it has not been so clearly demonstrated.

These opinions receive additional confirmation, when the brain is subjected to chemical re-agents, the manifestation of the fibrous structure being the uniform result; as, for instance, when a portion is immersed in alcohol, acids, boiling oil, or a solution of corrosive sublimate. Different fasciculi of these fibrils often intersect each other, or are interwoven; but all the fibrils of a fasciculus lie either parallel or concentric to each other. It was the opinion of Reil, according to his methods of unravelling the texture of the brain, that these fibres are disposed in lamellæ.

According to the views of the anatomists above mentioned, the spinal marrow consists of two lateral halves, separated in a great measure by the process of pia mater before mentioned, these columns being again composed of an anterior and posterior column. Towards its upper end, near the part where the spinal cord enters the cranium, the columns, of which it is composed, separate, and are also enlarged by the intervention internally of different masses of cineritious substance. The two posterior columns of the lateral halves, pass upwards and spread into the cerebellum.

The *posterior columns* are more or less separated into three fasciculi, or crura before mentioned, two of which are smaller, and situated more inwards, namely, the ascending, or crus cerebelli ad eminentiam quadrigeminam, and the descending, or crus cerebelli ad medullam oblongatam, which, interwoven together, form chiefly the middle part. The remaining and larger fasciculus, and which surrounds the two former, is called the crus ad pontem, and, by the spreading of its fibres, forms chiefly the medullary part of the hemispheres of the cerebellum.

The *anterior columns* decussate and form the projections, called the corpora pyramidalia, situated on their anterior surface. Within their substance are placed the corpora olivaria, the fibres splitting into an anterior and posterior layer to receive them. The anterior columns then decussate; the column of the right side going to the left, and that of the left going to the right side, and afterwards pass through the transverse fibres of the pons Varolii; the different bundles of fibres being separated from each other by the cineritious substance and transverse fibres of the crus cerebelli. Before the pons they form the crura cerebri. These diverge, pass into each hemisphere of the cerebrum, and are continued under and through the two central masses of cineritious substance, the thalami, namely, and the corpora striata, which have been called the ganglia of the cerebrum: and here their fibres radiate and diverge towards the circumference of the hemispheres, of which they form the principal part.

The convolutions of the cerebrum are described by Gall and Spurzheim to have a fissure extending through them from the ventricles, or as made up of two layers or lamellæ applied to each other. These may be separated, and the appearance of the convolutions, which in cases of hydrencephalus is rendered more or less obscure by collections of water during life, may be destroyed in the dead subject by an appropriate direction of mechanical pressure.

The lateral halves, both of the spinal marrow and brain, are not merely placed contiguous to each other, but are connected by means of medullary fibres and cineritious substance. The parts at which these connexions take place may be called generally the *commissures*. The *laminæ* of the spinal marrow have been spoken of. The commissure of the cerebellum is the *pons Varolii*: those of the cerebrum are the *corpus callosum* and the *commissures* seen in the third ventricle. The commissures, generally, are narrower than the parts which they connect. They extend much farther into the lateral halves, than the first superficial inspection might lead us to suppose. Thus, as has been before described, there is one set of fibres which ascend and have a longitudinal direction, whilst the other set, belonging to the commissures which connect but do not blend with them, have a transverse direction. These two orders have been distinguished by Gall by the terms converging, returning, or the transverse fibres; and diverging, departing, or the longitudinal fibres.

The *cineritious substance* does not form, like the medullary, a whole of which all the parts are connected. On the exterior it forms an uninterrupted cortex or rind, but it is not connected with the internal masses, and these do not in all parts even communicate with each other. The medullary substance exceeds by far in quantity the cineritious.

It is humiliating to the scientific anatomist to reflect, that the dissection of the most important part of the human body should yet be that which rewards us with the least satisfying results. The mechanism and the purposes of its several portions are alike obscure: a truth, of which their very names, all fanciful, and not a few deserving a less honorable epithet, may be regarded as an involuntary confession.

Morbid Appearances within the Cranium. Processes of bone from the cranium. Of the Membranes: Inflammation—Adhesion—Effusion—Suppuration—Ulceration—Gangrene—Excrescences—Hydrocephalus externus—Ossification of dura mater—Thickening of tunica arachnoides—Ossification of pia mater. Of the Brain: Effusion of blood or serous fluid into its substance—Effusion of serous fluid into ventricles—Hydrocephalus internus—Tumours in Brain—Abscesses—Substance of brain very soft or very firm—Hydatids of plexus choroides.

§ 3. OF THE PAROTID GLAND AND THE MUSCLES OF THE FACE.

The extent and connexions of the parotid, the largest salivary gland, and its duct, are first to be traced. The salivary glands consist of three pairs.

Parotid Gland. Is named from its situation near to the ear. It reaches from the zygomatic arch downwards to below the angle of the jaw, covering a portion of the masseter, and occupying the space between the ascending plate of the jaw-bone and the mastoid process. This, however, is merely its superficial extent; it is continued to the root of the meatus externus, adhering to the internal pterygoid muscle, is folded over the posterior edge of the masseter muscle, and lies deep seated between the ascending plate of the jaw-bone, and mastoid process. The under end of it is contiguous to the submaxillary gland, and is sometimes joined with it. The *duct of the parotid* is arising from the anterior margin of the gland; its course may be marked generally by a line drawn from the junction of the lobe of the ear with its pinna to the base of the nose, and passing immediately below the malar eminence. It receives often a small duct from a corresponding glandular process situated above it on the masseter, the *glandula accessoria of Haller*. The duct continues its course in the just described direction over the anterior margin of the masseter muscle descends a little, and perforates the buccinator muscle opposite the second molar tooth of the upper jaw.

The parotid has a covering of a dense cellular texture. It is of a greyish colour, and of a tolerably dense and firm texture. It is made of a number of lobes, which are easily seen, united by cellular membrane, and these lobes are again made of other smaller ones, from which the excretory duct is arising by minute radicles.

a. PALPEBRAL REGION, containing the muscles of the eyelid and eyebrow.

1. ORBICULARIS PALPEBRARUM, surrounds the eyelids.

Origin. Fleshy from the orbitar process of the superior maxillary bone. The fibres pass downwards, then outwards, spreading over the under eyelid and upper part of the cheek; they surround the outer angle, and then run inwards over the superciliary ridge, and spread over the upper eyelid: they descend then to the inner angle, adhering to the internal angular process of the os frontis, and to a short round tendon, which is fixed to the nasal process of the superior maxillary bone and is commonly considered as the insertion of the muscle, but seems rather to connect and support the eyelids. This tendon may be perceived under the integuments, and points out the situation of the lachrymal sac.

2. CORRUGATOR SUPERCILII.

Origin. Fleshy from the internal angular process of the os frontis. It passes upwards and outwards, and extends as far as the middle of the superciliary ridge.

Insertion. Into the eyebrow, intermixing with the orbicularis palpebrarum.

b. NASAL, containing the

1. COMPRESSOR NARIS.

Origin. From the root of the ala nasi, where it is connected with part of the levator labii superioris alæque nasi. Its fibres spread upon the side of the nose towards the dorsum, where it joins with its fellow.

Insertion. Into the extremity of the os nasi and nasal process of the superior maxillary bone.

c. LABIAL, containing the muscles of the mouth and lips, of which there are nine pair; viz. three above, three below, and three on the outer side; and the single muscle which surrounds the mouth.

1. LEVATOR ANGULI ORIS.

Origin. From the hollow of the superior maxillary bone below the foramen infra orbitarium.

Insertion. Into the angle of the mouth.

2. LEVATOR LABII SUPERIORIS ALÆQUE NASI.

Origin. By two fleshy attachments. The first from the external part of the orbitar process; and the second from the nasal process of the superior maxillary bone.

Insertion. Of the first slip into the upper lip, and of the second into the upper lip and outer part of the wing of the nose.

3. DEPRESSOR LABII SUPERIORIS ALÆQUE NASI.

Origin. Thin and fleshy from the superior maxillary bone near the roots of the incisor and cuspidatus teeth. It runs upwards.

Insertion. Into the upper lip and root of the ala nasi.

4. DEPRESSOR ANGULI ORIS.

Origin. Broad and fleshy from the outer edge of the fore and lateral part of the lower jaw. It runs over the origin of the depressor labii inferioris becoming gradually narrower.

Insertion. Into the angle of the mouth, intermixing with the zygomaticus major and levator anguli oris.

5. DEPRESSOR LABII INFERIORIS.

Origin. Broad and fleshy from the under part of the lower jaw, at the side of the chin, and runs obliquely upwards.

Insertion. Into about half of the edge of the under lip.

6. LEVATOR LABII INFERIORIS.

Origin. From the inferior maxillary bone near the roots of the incisor and cuspidatus teeth.

Insertion. Into the under lip and skin of the chin.

7. ZYGOMATICUS MAJOR.

Origin. Fleshy from the os malæ near its junction with the temporal bone.

Insertion. Into the corner of the mouth.

8. ZYGOMATICUS MINOR, frequently wanting.

Origin. From the upper and prominent part of the os malæ.

Insertion. Into the upper lip, near the corner of the mouth.

9. BUCCINATOR.

Origin Tendinous and fleshy from a ridge extending between the last molar tooth and the root of the coronoid process of the lower jaw; from the upper jaw between the last molar tooth and the root of the pterygoid process of the sphenoid bone, and from the extremity of that process. Its fibres pass straight forwards, adhering to the membrane which lines the mouth.

Insertion. Into the corner of the mouth.

10. **ORBICULARIS ORIS** (sphincter labiorum). This is a sphincter muscle which surrounds the mouth, and forms a considerable part of the lips. It seems to be formed in a great measure by the muscles, which have been just described: their fibres decussating at the corners of the mouth, and running along the lips.

A portion of this muscle, attached to the septum of the nose, is sometimes described as a separate muscle, under the name of the *nasalis labii superioris.*

c. **MAXILLARY,** containing the muscles which principally move the lower jaw.

1. **MASSETER,** covers a considerable part of the side of the lower jaw.

Origin. Tendinous and fleshy from the superior maxillary bone, where it joins with the os malæ, and from the whole length of the under and internal part of the zygoma. The external part of the muscles consists of fibres which have an oblique direction backwards, and of the internal part of fibres which are directed downwards and forwards. It forms a very strong muscle, of which the fleshy fibres are intermixed with tendon.

Insertion. Into the angle of the lower jaw, and into the external part of that bone upwards to the coronoid process.

2. TEMPORALIS.

The origin and situation of this muscle have been already described. Its insertion may now be traced.

Insertion. By a strong tendon into the coronoid process of the lower jaw, which it incloses, and is continued nearly to the last molar tooth.

3. PTERYGOIDEUS INTERNUS. Is situated to the inner side of the angle and ascending plate of the lower jaw.

Origin. Tendinous and fleshy from the internal plate of the pterygoid process of the sphenoid bone, filling up the space between the plates, and from the pterygoid process of the os palati.

Insertion. Into the angle of the inferior maxillary bone internally.

4. PTERYGOIDEUS EXTERNUS. Situated to the inner side of the cervix of the lower jaw, and may be seen after removing the buccinator.

Origin. From the outer side of the external plate of the pterygoid process of the sphenoid bone, from the tuberosity of the superior maxillary bone adjoining to it, and from the root of the temporal process of the sphenoid bone.

Insertion. Into the cervix of the lower jaw, and adheres to the capsular ligament.

The two above muscles cannot be completely displayed till the lower jaw has been divided, which is done at an after-stage of the dissection.

§ 4. OF THE ACTIONS OF THE MUSCLES WHICH PRODUCE THE MOVEMENTS OF THE LOWER JAW.

The direct motions of the lower jaw are :—*downward*—*upward*, by which the teeth are brought into contact—*forward*—*backward*. The muscles therefore may be arranged as—*a.* DEPRESSORS, *b.* ELEVATORS, *c.* MOTORS FORWARD, *d.* MOTORS BACKWARD.

a. DEPRESSORS.

1. Digastrici.

2. Mylo-hyoidei.
3. Genio-hyoidei.
4. Genio-hyo-glossi.

For the action of these muscles the os hyoides must be fixed by other and appropriate muscles.

b. ELEVATORS.

1. Temporales.
2. Masseteres.
3. Pterygoidei interni.
4. Pterygoidei externi.

c. MOTORS FORWARD.

1. PTERYGOIDEI EXTERNI, assisted at the commencement of their action by the pterygoidei interni, and part of the temporales and masseteres.

d. MOTORS BACKWARD.

1. Temporales.
2. Masseteres.
3. Digastrici.
4. Mylo-hyoidei.
5. Genio-glossi.
6. Genio-hyo-glossi.

CHAPTER II.

Of the Muscles of the fore part of the Neck, distributed into regions, and of some parts similarly situated.

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§ 1.

a. Muscles in the Superficial Cervical Region, containing the

1. Platysma Myoides (musculus cutaneus) which consists of a thin muscular expansion, situated immediately under the skin of the side of the neck.

Origin. By a number of thin fleshy slips, from the cellular substance, which covers the upper parts of the deltoid and pectoral muscles. These slips pass obliquely upwards, along the side of the neck.

Insertion. Into the side of the lower jaw, and the skin which covers the lower part of the masseter muscle and parotid gland, and is connected with the depressor anguli oris.

2. Sterno-cleido Mastoideus. Runs obliquely along the fore part and side of the neck, and forms a projection, which is very distinct in the rotations of the head in the living subject.

Origin. By two distinct attachments: the first, tendinous and fleshy from the upper bone of the sternum, near its junction with the clavicle; the second, fleshy from the fore and upper part of the clavicle. The two heads unite a little above the clavicle to form a strong muscle, which runs obliquely upwards and outwards.

Insertion. Tendinous into the mastoid process, which it surrounds, and becoming thinner into the temporal bone as far back as its junction with the os occipitis.

The attention should now be directed to the *submaxillary gland,* of which the situation, extent, and connexions, are to be examined.

SUBMAXILLARY GLAND. Is smaller than the parotid gland, and is of an oblong figure. It is situated behind the inferior maxillary bone, between the bellies of the digastricus. It is continued on the outer side as far as the angle of the bone, between the mylo-hyoideus and pterygoideus internus. It is separated from its fellow on the inner side by the digastricus and genio-hyoideus. Its structure is the same as that of the parotid, and its excretory duct formed in the same way; but its parietes are extremely thin. The duct proceeds from the deepest part of the gland near the mylo-hyoideus, inwards and forwards, and terminates by the side of the frænum of the tongue, by a small and somewhat prominent orifice. In its course it is placed, first between the mylo-hyoideus and hyo-glossus, then between the genio-glossus and sublingual gland, and lastly covered by the membrane of the mouth.

The muscles which are attached to the os hyoides are next to be dissected. They are distributed into two regions, the *superior* and *inferior hyoideal.* But before we proceed with the dissection it is necessary to have a general knowledge of several parts with which they are connected.

OS HYOIDES. Is situated at the upper part of the neck, and may be felt beneath the integuments. It gives the points of attachment to the base of the tongue and to the principal muscles connected with that organ. It is of a horse-shoe shape, and is divided into a *base* or broad part, placed in front, and into two *cornua,* which extend backwards on each side. Two other smaller processes, called *Appendices,* are placed at the upper part of the bone where the cornua are joined with the base.

LARYNX. Is situated beneath the os hyoides. It is composed of five elastic cartilages, connected by ligament and membrane, viz.

THYROID CARTILAGE. The largest of these, which forms the upper and fore part. It is formed of two lateral portions, or *alæ,* united in front, where they form a projection in the male, distinct in the living subject, called the pomum Adami. From the upper and posterior angle of each ala a process extends upwards, called the *superior cornu.* From the lower and posterior angle a similar, but shorter, process reaches downwards, named the *inferior cornu.*

CRICOID, or annular cartilage. Is placed below the thyroid. It forms the under and back part of the larynx. It is narrow in front, immediately below the thyroid, but increases in breadth at the sides and back part.

The three other cartilages, which enter into the composition of the larynx, are the two Arytenoid and the epiglottis. The TWO ARYTENOID CARTILAGES, are of small size, and of a pyramidal shape; they are situated at the upper and back of the cricoid cartilages. THE EPIGLOTTIS is of a leaf-like shape, is placed just below the root of the tongue, and covers the upper opening into the larynx.

TRACHEA, or air-tube. Is continued from the cricoid cartilage down the fore part of the neck into the chest. It is rounded in front and flattened behind, and is composed principally of cartilage and membrane.

THYROID GLAND. Is situated at the under and lateral part of the larynx, and extends upon the trachea. It is formed of two considerable lobes, of a reddish colour, connected by an intermediate portion, which lies across the fore and upper part of the trachea.

Behind the nose and mouth is the PHARYNX, a membranous bag, which contracts below, and terminates opposite to the cricoid cartilage in the œsophagus.

ŒSOPHAGUS. Is a cylindrical muscular tube, through which the food descends into the stomach. It passes down behind the trachea into the chest, and is inclined in its course rather to the left. It rests behind upon the cervical vertebræ, and is connected before with the trachea.

As a more particular description of these parts will be given hereafter, the dissection may now be continued.

b. SUPERIOR HYOIDEAL REGION, containing the muscles between the os hyoides & lower jaw.

1. DIGASTRICUS.

Origin. Tendinous and fleshy from the digastric fossa, at the root of the mastoid process of the temporal bone. It passes downward and forward, and forms a strong round tendon, which passes through the stylo-hyoideus, and is fixed by ligament to the os hyoides. It runs then obliquely upwards and forwards, and forms a second fleshy belly.

Insertion. Into the rough surface at the under part of the symphysis of the lower jaw.

2. STYLO-HYOIDEUS.

Origin. From the under half of the styloid process. It runs downward and forward.

Insertion. Into the os hyoides at the junction of the base and cornu.

3. MYLO-HYOIDEUS. Is displayed by detaching the anterior belly of the digastricus.

Origin. Broad and fleshy from the inside of the lower jaw, between the last dens molaris, and the middle of the chin.

Insertion. Into the lower edge of the base of the os hyoides, and joins with its fellow between that bone and the lower jaw.

The mylo-hyoideus is next to be laid back from its attachment to the lower jaw, and then the sublingual gland may be dissected, and the duct of the submaxillary gland traced to the mouth.

SUBLINGUAL GLAND. Is the smallest of the salivary glands. It is placed as its name implies, lying horizontally upon the inferior surface of the tongue. It is parallel to its fellow, and separated from it by the genio-glossi. To the outer side it corresponds to the membrane of the mouth, above to the tongue, and below to the mylo-hyoideus. Its structure is the same as that of the other salivary glands; but that its excretory apparatus generally consists of a number of small ducts, which, after a short passage, open by the sides of the frænum of the tongue. Sometimes there is one duct considerably larger than the rest: and its coats thin and transparent.

4. GENIO-HYOIDEUS.

Origin. Tendinous, from a rough protuberance on the inside of the lower jaw, close to the symphysis.

Insertion. Into the base of the os hyoides.

c. INFERIOR HYOIDEAL REGION, containing principally the muscles between the os hyoides and trunk.

1. OMO-HYOIDEUS.

Origin. Thin and fleshy from the superior costa of the scapula, near the notch, and from the ligament which runs across it. It passes obliquely upwards and forwards, becomes tendinous behind the sterno-mastoid muscle, and again grows fleshy.

Insertion. Into the base of the os hyoides, at the side of the sterno-hyoideus.

2. STERNO-HYOIDEUS.

Origin. Thin and fleshy from the upper bone of the sternum internally, from the cartilaginous extremity of the clavicle, and from the clavicle, near the sterno-clavicular articulation.

Insertion. Into the base of the os hyoides.

3. STERNO-THYROIDEUS.

Origin. Fleshy from the uppermost bone of the sternum, and from the adjacent part of the cartilage of the first rib.

Insertion. Into the rough oblique line on the ala of the thyroid cartilage externally.

4. THYREO-HYOIDEUS.

Origin. From the rough line opposite to the former.

Insertion. Into part of the base, and almost all the cornu of the os hyoides.

5. CRICO-THYROIDEUS.

Origin. From the side and fore part of the cricoid cartilage, and runs obliquely upwards and backwards.

Insertion. Into the under part, and into the inferior cornu of the thyroid cartilage.

The next muscles, which are to be dissected, are those of the lingual region, or those which are concerned in the motions of the tongue. Previously to examining them it will be advisable to saw through the lower jaw, between the incisor and cuspidatus teeth, and to turn the detached portion of the lower jaw outwards. By these means a clearer view is gained of the muscles by the side of the tongue; and the pterygoidei muscles will be more completely displayed. It will be proper likewise to have a general knowledge of the anatomical division of the tongue before prosecuting the dissection.

TONGUE. Is situated between the branches of the lower jaw. Its upper surface is unconnected, while the lower part, except anteriorly, is attached, by means of membrane and muscles, to the lower jaw and os hyoides. It is divided into *base*, *body*, and *apex*. The *base* is the part attached to the os hyoides. The *apex* is the moveable and unconnected point, which is protruded between the teeth. The *body* is the middle portion, the upper surface of which is called *the dorsum*, and is seen when the mouth is opened, and of which the lateral parts are called the *sides*.

d. LINGUAL REGION, containing the muscles belonging to the tongue.

1. GENIO-HYO-GLOSSUS.

Origin. Tendinous, from a rough protuberance, close to the symphysis of the lower jaw internally; it spreads, like a fan, under the tongue.

Insertion. Into the whole length of the under and lateral part of the tongue, and into the base of the os hyoides.

2. HYO-GLOSSUS.

Origin. Broad and fleshy from the base, cornu, and appendix of the os hyoides, and passes upward and forward.

Insertion. Into the side of the tongue near the stylo-glossus.

3. LINGUALIS.

Origin. From the root of the tongue laterally. It runs forwards between the hyo-glossus and genio-glossus.

Insertion. Into the apex of the tongue with the stylo-glossus.

4. STYLO-GLOSSUS.

Origin. Tendinous and fleshy from the styloid process, and from the ligament which is extended between that process and the angle of the lower jaw.

Insertion. Into the base of the tongue laterally, runs along its side, and is continued as far as the apex.

The next muscles, in the order of dissection, are those situated about the passage of the fauces, or in the guttural region, before the examination of which it will be necessary to consider the principal parts with which they are connected.

PARTS AT THE PASSAGE OF THE FAUCES.

When the mouth is opened, a membranous expansion is seen at its back part, called the *velum pendulum palati,* which extends from right to left, in the form of an arch. From its middle the *uvula,* or pap of the throat, projects downwards towards the root of the tongue. On each side from the root of the uvula and velum two *arches* or *columns,* distinguished by the names of anterior and posterior, are sent down, which diverge and terminate, the first at the root of the tongue, and the second on the side of the pharynx. Between the anterior and posterior arches on each side, are situated the *tonsils,* or amygdalæ. The passage between the arches is called the *isthmus faucium.*

e. GUTTURAL REGION, containing the muscles situated about the passage of the fauces.

1. CIRCUMFLEXUS PALATI (tensor palati).

Origin. From the spinous process of the sphenoid bone, and from the bony and cartilaginous part of the Eustachian tube. It runs down along the pterygoideus internus, forms a slender round tendon, which passes over the hook of the internal plate of the pterygoid process, and then spreads within the velum.

Insertion. Into the velum pendulum palati, and into the semilunar edge of the os palati, extending as far as the palatine suture.

2. LEVATOR PALATI.

Origin. Tendinous and fleshy from the point of the petrous portion of the temporal bone, and from the membranous portion of the Eustachian tube.

Insertion. Into the velum pendulum palati as far as the root of the uvula, where it joins with its fellow.

3. CONSTRICTOR ISTHMI FAUCIUM.

Origin. From the side of the tongue near its base. It runs upwards within the doubling of membrane, which forms the anterior arch of the fauces.

Insertion. Into the middle of the velum palati at the root of the uvula, where it is connected with its fellow.

4. PALATO-PHARYNGEUS.

Origin. From the middle of the velum palati, at the root of the uvula, and from the tendinous expansion of the circumflexus palati. The fibres are collected within the posterior arch, and then spread in the upper and lateral part of the pharynx, mixing with those of the stylo-pharyngeus.

Insertion. Into the edge of the upper and back part of the thyroid cartilage; some of its fibres being lost between the membrane and two inferior constrictors of the pharynx.

5. AZYGOS UVULÆ.

Origin. From the palate bones, where they are joined by suture. It runs through the middle of the velum palati, and through the whole length of the uvula.

Insertion. Into the tip of the uvula.

e. PHARYNGEAL REGION, containing the muscles of the pharynx.

1. STYLO-PHARYNGEUS.

Origin. Fleshy from the root of the styloid process.

Insertion. Into the side of the pharynx, and into the back part of the thyroid cartilage.

The other muscles of the pharynx, consisting of the three constrictors, will be most conveniently dissected by cutting through the trachea and œsophagus, and then drawing them upwards and forwards, so as to bring into view the back part of the pharynx, the cavity of which should be previously stuffed.

2. CONSTRICTOR PHARYNGIS INFERIOR,

Origin. From the sides of the thyroid and cricoid cartilages. The superior fibres run obliquely upwards, covering the under part of the next muscle; the inferior fibres run more transversely.

Insertion. By joining with its fellow at a white line, which is continued along the middle of the back part of the pharynx.

3. CONSTRICTOR PHARYNGIS MEDIUS.

Origin. From the appendix and cornu of the os hyoides, and from the ligament which connects the cornu to the thyroid cartilage. The fibres run obliquely upwards, cover a considerable part of the superior constrictor, and terminate in a point.

Insertion. Into the cuneiform process of the os occipitis, and is connected with its fellow at a white line on the middle of the back part of the pharynx.

4. CONSTRICTOR PHARYNGIS SUPERIOR.

Origin. From the cuneiform process of the os occipitis, from the pterygoid process of the sphenoid bone, and from both jaws near the last dentes molares. Between the jaws it intermixes with the buccinator muscle, and is connected with the root of the tongue and palate.

Insertion. By joining with its fellow at a white line in the middle of the back part of the pharynx.

§ 2.

The description of the actions of all these muscles would require more space, and greater detail, than can be allotted to them in this Work. It will be advisable to confine the attention to those muscles which are attached to bone, and therefore, in this instance, to describe only the actions of the muscles which move the os hyoides.

The movements of the os hyoides are *upward* and *downward.* The muscles are therefore arranged—*a.* ELEVATORS, *b.* DEPRESSORS. There are also slight movements *forward* and *backward.*

a. ELEVATORS.

1. Digastrici.

2. Mylo-hyoidei.
3. Genio-hyoidei.
4. Genio-hyo-glossi.
5. Stylo-hyoidei.

b. DEPRESSORS.

1. Sterno-hyoidei.
2. Sterno-thyroidei, } acting by the intervention of
3. Thyreo-hyoidei, } the thyroid cartilage.
4. Omo-hyoidei.

CHAPTER III.

Of the Thorax.

§ 1. OF PARTS EXTERIOR.

Of the muscles belonging to this division, a part have been already presented in the course of dissection adopted; and others will be described in the place most convenient for their examination. We commence then with mamma.

Mamma. Is a gland peculiar to the female, of a rounded form, situated on the anterior, and a little towards the lateral part of the thorax; it adheres loosely, by cellular substance, to the surface of the large pectoral muscle, in part to the serratus magnus, extends as far as the axilla. It is of a flattened oval figure, and of a whitish colour. It is formed of numerous small lobes, united by a dense cellular texture, but the lobes are often not so much agglomerated towards the circumference; and these lobuli are again composed of smaller glandular masses. Its execretory ducts, called the *lactiferous tubes,* arise by minute radicles from all these glandular masses: they gradually unite into larger canals or trunks, run in a radiated manner towards the root of the nipple, and lastly form from twelve to eighteen larger tubes terminating at the *nipple,* or papilla. This is situated near the centre of the mamma. It is of a cylindrical form, of a redder colour than the rest of the skin of the breast: and composed of the elastic tough cellular substance, which incloses the lactiferous tubes. These are at a little distance from each other, and are coiled up; but when the nipple is drawn out and extended, the ducts become straight and parallel to each other. There is no communication between the lactiferous tubes, and sometimes one or more of them terminate upon the surface of the areola. Upon the apex of the nipple the orifices of the lactiferous ducts appear, and are of the same number with those which enter the base.

Around the nipple there is a circle, or disk, called *areola*, of a different colour from the rest of the skin of the breast. It varies in colour at different times of life, and during pregnancy is of a darker colour than at other times, in consequence of a change which takes place in the rete mucosum. In the skin of the areola there are numerous sebaceous glands, or follicles.

§ 2. OF THE CONTENTS OF THE THORAX.

The thorax or chest is the superior portion of the trunk: of a conical figure, the broadest part expanded over the upper part of the abdominal viscera. Its parietes are formed by the dorsal vertebræ, the ribs, and the sternum, assisted by the clavicle. These bones are bound together by strong ligaments. Their interstices are filled up by the intercostales, the sterno-costales, the levatores and depressores costarum. There are likewise placed upon the chest strong muscles belonging to the vertebral column, the upper extremity, and abdomen. The contents of the thorax are the heart and pericardium, the two lungs and their investing membranes, the pleuræ, and the contents of the mediastinum.

The dissection is to be commenced by removing five or six of the upper ribs, in order to display the pleura, which is to be carefully separated from the ribs.

Pleura. A thin semitransparent membrane lining the parietes internally. Externally, where it is attached to the parts which it covers, it is cellular; internally, it is smooth, and lubricated by a small quantity of serous fluid, which exists in the form of vapour in the living state. It is called a *reflected* membrane. The term, *reflected*, which is likewise applied in a similar sense to other membranes having a similar disposition, is here equivalent to *turned back*. Thus it gives a close covering to the lung, and is then turned back to give it a second covering, which adheres to the parietes; the investing portion and the reflected portion being continuous, and their internal surfaces in contact throughout, but smooth and without attachments, so as to form a circumscribed cavity without outlet, containing only the proper secretion of the membrane. The term, cavity, here and in other instances, is not meant to imply actual interspace or vacuity. It denies the adhesion and connexion, *not* the contact, of the surfaces by which it is formed. If, therefore, the pleura were separated from the parts, with which it is exteriorly connected, it would be seen that the lung, though invested by it as an envelope, is not contained *within* it, as a bag. On opening the bags of the pleura, the lungs are seen loosely placed, connected only by their roots.

In examining the extent of the pleura, it must be traced over the parts which it covers: this is called tracing the *reflection of the pleura.* The description may be begun at the lateral parts of the sternum; the pleura passes thence outwards upon the parietes of the chest, which it covers throughout, in connexion with the ribs and intercostal muscles, as far as the vertebral column; inferiorly, it covers the convex surface of the diaphragm, superiorly, it terminates a little above the first rib in a blind extremity. It passes forwards from the vertebral column, approaches the opposite pleura, leaving a space before the spine, and is continued on to a small portion of the pericardium. Leaving this it passes over the posterior part of the pulmonary vessels on to the surface of the lung, extending over its summit, and its base, exactly adapting itself to the irregularities of its surface, and giving a distinct covering to each lobe. The pleura passes then from the lung over the anterior part of the pulmonary vessels, is continued upon the pericardium, which it covers, approaches the opposite pleura, and terminates at the posterior part of the sternum, where the tracing commenced.

The portion of the pleura which lines the ribs and intercostal muscles is called the *pleura costalis,* and that part covering the lung is termed the *pleura pulmonalis.* These two portions are constantly in contact, whether in exspiration or inspiration, so exactly are the lungs adapted to the parietes of the chest; but after the bag of the pleura is opened, the lung collapsing leaves a considerable space between it and the parietes.

The cavity of the thorax may now be more completely laid open by dividing the cartilages of the ribs close to their union with the bones, and then raising gradually the sternum, with the cartilages attached to it, from below upwards. It will be then seen, that in the middle of the chest, the two *pleuræ* are contiguous to each other, and divide the chest into two unequal cavities, of which the left is the smaller. This separation passes between the sternum and the spine, and is called the *mediastinum.*

MEDIASTINUM. The mediastinum is divided into the *anterior* and *posterior* mediastinum.

ANTERIOR MEDIASTINUM. Is formed by the pleuræ approximating behind the sternum from the cartilages of the first ribs and pericardium. Nearly opposite to the fourth rib it is inclined to the left margin of the sternum, and terminates about the sixth rib. The direction of the mediastinum, however, varies a little in different subjects. A small quantity of cellular membrane is interposed between the layers of the pleuræ, and at an early period of life in its upper part the remains of the thymus gland are frequently found.

THYMUS GLAND. The thymus gland, placed in the anterior mediastinum, after birth begins to be absorbed, and in age few traces of it are to be found. In the fœtal state it is of considerable size, of a pale red colour, and is composed of two lobes. It has two cornua above and two below: the two inferior are rounded and thicker, and not unfrequently descend as low as the diaphragm; the two superior are more pointed and slender, and ascend in the neck as high as the thyroid gland. The two lobes are made up of numerous lobuli, connected by cellular membrane, and when they are cut into, a milky fluid may be squeezed from them.

POSTERIOR MEDIASTINUM. Is formed by the two portions of the pleuræ, which pass between the posterior part of the pericardium and the dorsal vertebræ. It is most conveniently dissected by turning the left lung over to the right side, fixing it in that situation, and cutting through the pleura on the left side. Its contents may then be examined. It contains the *aorta*, the main trunk of the arterial system, which is placed rather to the left side upon the vertebræ; the *œsophagus*, the muscular tube which conveys the food from the pharynx to the stomach, which is situated before the aorta, and inclined to the right; the *Vena azygos*, a vein which returns the blood from the intercostal spaces, which takes its course close to the spine upon its anterior part, and the *thoracic duct*, the main trunk of the absorbent vessels. This last vessel is about the size of a quill, and its coats thin and semitransparent: after having passed between the crura of the diaphragm, it is situated to the right of the aorta, having its place between that vessel and the vena azygos in its ascent. We may now examine the

PERICARDIUM. It is the investing membrane of the heart, and like the pleura is a reflected membrane. It is situated in the middle of the chest, between the two pleuræ, which it separates, and is connected with the tendon of the diaphragm. It is wider below than at the part above, where it is continued upon the vessels of the heart. Externally, where it is attached to the surrounding parts, it appears cellular. On cutting open the pericardium, its internal surface is found smooth and polished, and lubricated by a serous fluid, called the *liquor pericardii*.

At this point of the dissection, it may be well to notice the situation of the heart. It is placed between the lungs, behind the sternum, resting upon the diaphragm, with its base towards the spine backwards. The apex is somewhat lower, inclined to the left side, and corresponds to the interval between the cartilages of the fifth and sixth ribs. The pericardium gives a close covering to the heart, so as to shew the exact figure of this viscus, and is continued on to the great vessels, which are connected with its base. From these it passes off so as to give a second covering to the heart, which is connected with the pleura, and forms like the pleura a circumscribed cavity.

The *vessels* arising from the heart are next to be examined. They are:—anteriorly, the *pulmonary artery* and the *aorta* placed behind, and in some measure concealed by it. By turning the heart to the left, the *vena cava superior* and *inferior* will be seen, placed behind, and to the right. By lifting the heart from its situation, the one or two right, and the two left, *pulmonary* veins, especially the two latter, may be seen passing from the lung on each side. These are often called the eight primitive vessels.

OF THE LUNGS.

The lungs (two in number) occupy the lateral parts of the thorax, and are moulded to the form of the cavities which they fill. Being thus exactly adapted to the parietes of the thorax, their figure cannot be regular, they may be laxly described as conical, and have been sometimes compared in figure to the foot of the ox. Externally toward the ribs they are convex. Internally they are flattened with an anterior depression for the reception of the heart: the pulmonary vessels enter them about the middle of their length. The anterior margin is sharp and thin: and in that of the left lung there is a hollow which receives the apex of the heart. The posterior and thicker margin is rounded, and received within the angles of the ribs. The base of the lungs is plane, and rests upon the diaphragm, to the form of which it corresponds, the surface facing downwards and forwards. The base is bounded by a thin, slightly indented edge. The summit (apex) is narrow, obtuse, and irregular, and is received into the cul de sac formed by the pleura, just above the level of the first rib.

Each lung is divided into *lobes;* the right lung into three lobes and the left into two. In observing the lungs from the side, a fissure will be seen to extend from a little below the apex obliquely forwards and downwards to the base. This fissure extends through the substance, and divides the lung into two lobes. The superior lobe is broad above, and terminates in a point below; whilst the inferior is pointed above, and occupies below nearly the whole of the base. The right lung is subdivided into three lobes, by a fissure which extends upon the superior lobe obliquely from above to below, and from within to without, varies in length and depth, and sometimes is wanting. Occasionally the left lung likewise has three lobes.

The volume of the lungs varies, according as they are in a state of dilatation or collapse; and in both states it depends on the quantity of air contained: for after respiration has been once performed, it is found that all the air cannot be again expelled. The same cause renders them specifically lighter than water.

The colour of the lungs is pale, or of a greyish white or yellowish brown, with small dark spots; but more commonly they are found of a red, livid, brown or violet colour, or of these colours variously intermixed. These are accidental varieties depending on the blood which may remain in the capillary vessels. In children they are more pink; but in age become livid, and interspersed with black spots.

The lungs are connected on their internal surface by the pleura, the *reflection* of which begins at this part; by the air-tube; and by the pulmonary vessels consisting of the artery which divides, and of the veins, two of which belong to each lung. The part where these are connected with the lung is called its *root*.

STRUCTURE OF THE LUNG. Is soft and lax, readily receiving and for some time retaining the impression of the finger. Some firmness is given to its texture by the pleura, which closely covers it, as its proper coat. Each lung is composed, 1. of the branches of a membranous and cartilaginous tube for the transmission of air, called trachea and bronchia; 2. of two sets of blood-vessels, the one consisting of the ramifications of the pulmonary artery, the other of those of the pulmonary veins; 3. of a reticular texture, which is always found devoid of fat.

The reticular membrane, having been previously destroyed by maceration, the lung is divisible (at least in the fœtus) into a number of lobules of various sizes and form, with angular surfaces, which contain cells, freely communicating with each other, called the *air cells*. Their communication is rendered evident from their ready inflation by the bronchia.

TRACHEA. Begins below the cricoid cartilage, extends through the middle of the neck to the upper and posterior part of the chest, and terminates about the second or third dorsal vertebra, by dividing into the right and left bronchus. Behind it is placed the œsophagus: before it are the sterno-hyoidei and sterno-thyroidei muscles. To the sides are the carotid arteries, jugular veins, &c.: above, it is surrounded by the thyroid gland. The trachea is convex before and flattened behind.

The *bronchi* separate from each other and pass to each lung, which they penetrate about the middle of the inner side. The left bronchus is somewhat less capacious than the right, but is longer, from the situation of the heart. Within the substance of the lungs they divide and subdivide into branches, called *bronchia*, which take different directions, are distributed to all parts of the lungs, and become at last so minute that they cannot be traced.

The lungs and heart may now be removed in one mass, and the trachea and its bronchi, the great vessels of the heart, and the bronchial glands are to be cleaned, for the more convenient examination of the structure.

The *trachea* is formed of *cartilages* of a horse-shoe form, being about two-thirds of a ring. They vary in number, but are generally about eighteen; are very elastic; broad, convex and strong, anteriorly; but thinner, posteriorly. They vary likewise in size and form; and it is not unfrequent for two or more to run into one. The first cartilage is generally the largest, and is often united with the cricoid, or next cartilage below it. In the ramifications of the bronchia, the cartilages are at first annular, they soon, however, become imperfect, of an irregular figure, and at length are lost.

An elastic *ligamentous* substance connects the rings of the trachea, and occupies the space between the ends of the cartilages. This is continued into the bronchia, and seems to be the principal constituent of the air-tube, where the cartilages become defective, but grows thin and indistinct in the minute branches.

The extremities of the rings are also connected by transverse bundles of *muscular fibres,* situated beneath the ligamentous tunic; and there appear likewise to be some muscular fibres, which near their extremities pass obliquely from one ring to the other.

The internal surface of the air-tube is lined by a *mucous membrane.* This probably extends into the minutest ramifications of the bronchia. Posteriorly, it is disposed in longitudinal folds, formed by longitudinal bands, which do not disappear when the membrane is separated. This membrane is highly vascular, as is proved by injection, and extremely sensible. It is constantly lubricated by a mucus, poured forth by small round *glands,* of a reddish, or yellowish colour; most of which are situated posteriorly, between the muscular and fibrous coat, and in the cellular membrane about the trachea. Upon the mucous membrane where the excretory ducts terminate, Pores are discovered; and similar pores are observed upon the membrane lining the branches of the bronchi.

About the beginning of the bronchi are situated numerous absorbent glands, called the *bronchial glands.* They vary in number, size, situation, and figure. Their colour in the adult is of a deep blue or brown; in age they become black, and in childhood they are reddish or white.

PULMONARY VESSELS. The vascular system of the lungs consists of two orders of vessels: the ramifications of the pulmonary artery and those of the pulmonary veins.

PULMONARY ARTERY. Takes its origin from the right ventricle of the heart. At the left side of the aorta it divides into two principal branches. The right passes behind the aorta and vena cava superior to enter the right lung before the bronchus: it is the longer of the two. The left, the shorter and less capacious, ascends directly to the left lung. They both divide in the lungs like the bronchi, the course of whose ramifications they follow, and are distributed to all parts of the lungs.

PULMONARY VEINS. Begin from the extremities of the pulmonary arteries. They take the course of the other vessels, and are collected into trunks, which terminate at last in four principal veins, two of which belong to each lung, and end in the left auricle. The right superior issues from the lung under the bronchus, and passes to the superior and right part of the auricle; the inferior ascends from the inferior lobe to the inferior and right part of the auricle. The left pass in like manner to the left side of the auricle, generally, however, being somewhat closer together.

According to the experiments of Haller and others, it would appear that these vessels have communication with the air-tubes: since fluids injected into them pass into the ramifications of the bronchia; and, vice versa, injected into the bronchia, pass into these vessels. But as Haller himself observes, we are not authorized to infer the existence of such communication in the living animal.

OF THE HEART.

The heart should now be prepared for dissection, by cutting through the great vessels at some distance from their origin, and dissecting from them the cellular membrane: but leaving the remains of the *canalis arteriosus,* which appears like a ligamentous cord stretched between the pulmonary artery before its division, and the under part of the arch of the aorta. Afterward the heart itself is to be examined.

The heart is of a conical figure, but is flattened on one side, where it rests upon the diaphragm, and is fixed only at its base, where it is connected by the great vessels. It is divided into *base, body,* and *apex,* with an *anterior* and *posterior surface,* and a *right* and *left margin.* The *right margin* is thin, and is therefore sometimes called acutus, and is generally fat. The *left margin* is thick and rounded, and is called sometimes obtusus. The *base* is placed posteriorly and superiorly towards the vertebral column, from which it is separated by the contents of the posterior mediastinum. The great vessels are annected to this part of the heart. The *apex* is placed anteriorly, inferiorly, and to the left. It corresponds to a slight depression in the lung, and to the space between the fifth and sixth ribs, where its pulsation may be felt during the dilatation of the auricles. It is surrounded generally by fat, and is sometimes divided.

The heart is double, or is formed of *two sides,* and each side is divided into two cavities; one of which is distinguished by the name of auricle, the other by that of ventricle: so that there are four cavities: *two auricles* and *two ventricles.* The sides have been named *right* and *left,* but improperly, as that called right is rather the anterior, and the left rather the posterior. The heart is the organ for the reception and propulsion of the blood. The auricles are the reservoirs, and are therefore connected with large veins supplying them: the ventricles are the propelling powers, and are therefore connected with the arteries. It is supplied with valves, which prevent the reflux of the blood.

RIGHT AURICLE. Forms a part of the base of the heart. Its figure is irregular; it is broad posteriorly, and to the right; it is narrow anteriorly, and to the left side, where it terminates in a projecting process called the *appendix.*

In order to demonstrate the internal structure of the auricle, it is to be opened by a double incision; the one transverse, begun at the part where the venæ cavæ unite, and extended into the appendix; and the other, carried from the middle of the first into the vena cava superior. The parts then seen are: *behind,* and at the *upper part* is the opening of the *superior cava,* directed obliquely downwards and forwards, formed by a rounded and projecting edge of muscular fibres. The opening has the same direction as that which forms the communication between the auricle and ventricle. At the *lower part* is the opening of the *in-*

ferior cava, which is directed obliquely inwards and upwards. At the part which is common to the two cavæ, Lower has described a tubercle, it is found in brutes, but in the human subject it is problematical, or at least extremely indistinct. At the circumference of the vena cava inferior is a projecting fold of the internal membrane, called the *valve of Eustachius,* which varies considerably in size, and often has small perforations. It begins inferiorly, is continued transversely upwards and inwards, and terminates on the partition of the auricle. Below the valve of Eustachius, and immediately above the ventricle, is the *opening of the coronary vein.* To prevent the reflux of the blood, the orifice is provided with a valve, which is called from its figure the *semilunar valve. Anteriorly,* and *above,* is the cavity of the *appendix,* from the sides of which project bundles of fleshy fibres, crossing each other, but covered by the membrane proper to the auricle. *Below,* is the opening which forms the communication between the auricle and ventricle, the *auricular,* or auriculo-ventricular *opening. To the inner side* the auricle is formed by the *septum* common to it, and the left auricle. In the septum is a depression called the *fossa ovalis,* bounded by a semilunar fold of membrane of considerable strength, the inferior extremity of which is continued with the valve of Eustachius. The bottom of the fossa is formed by a similar valve in the left auricle; and if the handle of a scalpel be passed between the valves, the adhesion may be commonly overcome so as to re-establish the opening of the foramen ovale, which in the fœtal state forms a communication between the two auricles.

RIGHT VENTRICLE. Is of larger size than the auricle, and of a pyramidal figure. Its upper part, or base, answers to the opening of communication with the auricle to the right, and that of the pulmonary artery to the left. Its inferior extremity is situated at the apex of the heart, but a little higher than that of the left ventricle.

The right ventricle should be opened by two incisions, one of which is carried along the upper part of the ventricle transversely, and the other by the side of the septum; the incisions meeting below the pulmonary artery. A triangular flap is thus formed, and the internal structure displayed. On its sides are found numerous bundles of fleshy fibres, called *carneæ columnæ,* which are so disposed as to form an irregular network; they are of various sizes, but the larger situated generally nearer the basis, and becoming more slender towards the apex; they project more or less from the sides, some remaining attached only at their extremities. Amongst them are three bundles, occasionally more, larger than the rest, and not always arising from the same part, which ascend perpendicularly, and terminate in a rounded extremity; from these arise *tendinous cords* (chordæ tendineæ) which diverge, and attach to a membranous fold, from the margin of the auricular opening.

There are two openings from the ventricle, that of communication with the auricle superiorly, and to the right; and that of the pulmonary artery superiorly, and to the left. The *auricular opening* is the larger, and occupies nearly the whole of the base of the ventricle. Its boundary is marked by a white line, which has been called the *tendinous zone* (zona tendinea), but which appears to be nothing more than condensed cellular membrane. From the margin of the opening is extended a loose membranous fold, the edge of which has three points, or projections, and has been called the cortina tendinea; it is fixed, as has been before observed, by means of the *tendinous cords* to the *carneæ columnæ* and forms in this manner the *tricuspid valve.* The *opening of the pulmonary artery* is placed obliquely. Towards it the bundles of fleshy fibres become larger, thicker, and less numerous. At the beginning of the artery are three valves, called the *sigmoid,* or *semilunar.* Two are on the fore, one on the back part of the artery. Each of them forms a sac, which is attached by its convex edge to the sides of the artery, whilst the other is loose and projecting. The unattached edge is somewhat thicker and stronger than the rest of the valve. It has in its middle a small body, or thickening, called *corpusculum sesamoideum* or *Arantii.*

At the part, where the pulmonary artery divides, a ligamentous rounded cord of some size arises from it, and passes to the concave part of the curvature of the aorta, to the side of which it is attached. It is the remains of the *canalis arteriosus,* a vessel which, in the fœtus, forms a communication between the pulmonary artery, and the aorta.

The LEFT SIDE is composed, like the right, of an auricle and a ventricle.

LEFT AURICLE. It receives from each side the pulmonary veins, and it terminates to the left, and somewhat anteriorly, in a projecting appendix, which is all that can be seen of the left auricle in the natural situation of the heart. If the heart be raised and turned to the right, the posterior surface will be seen, which is covered by the pericardium. The form of the whole is irregular, and its extent cannot be ascertained without introducing the finger into its cavity. In order to examine the internal structure of the auricle, it is to be opened without injuring the pulmonary veins, which may be accomplished by a crucial incision between them. The *inner side* is formed by the septum of the auricles, on the surface of which is a kind of semilunar valve, the convex edge of which passes continuously into the surface of the auricle behind. This fold of membrane is applied to the corresponding valve of the right auricle; but is so situated with respect to it, that if they were separated from each other, the passage between the auricles would be oblique. The concave edge of the valve bounds a space like that of the fossa ovalis of the right side, but less deep. *To the right* the pulmonary veins of that side enter, the one from above to the upper part, the other from below obliquely to the lower part, and *to the left* are seen the openings of the two left pulmonary veins. The latter are close to each other, and sometimes form but a single opening. Before them is the cavity of the *appendix:* its surface is unequal from bundles of muscular fibres, but which are not so numerous as those in the appendix of the left auricle. *Below,* and *anteriorly,* the auricle is terminated by a large opening, by which it communicates with the left ventricle; namely, by the auriculo-ventricular opening.

LEFT VENTRICLE. Its form is conical, somewhat like the less end of an egg. In consequence of the thickness of its parietes, it does not become flattened when empty, like the right; but appears rounded transversely. It is longer than the right ventricle, its apex projecting more.

Its internal structure is best displayed by two incisions, one carried along the septum, the other along the upper part of the ventricle transversely, so as to meet the first below the opening of the aorta. They thus form an L reversed (⅃).

The internal surface presents a network of bundles of muscular fibres, not so numerous, however, nor so irregularly disposed, as those in the right ventricle. Two columns (carneæ columnæ) considerably larger than the others, arise from the middle of the parietes, the one from the anterior, the other from the posterior surface. These pass from below upwards, obliquely in the cavity, towards the base. The column is not always single, but often consists of two, or more shafts, terminating in a rounded extremity; from which arise minute *tendinous cords* (chordæ tendineæ), that diverge and become attached to the edge of the membranous fold, which extends from the margin of the auricular opening. The left ventricle terminates superiorly by two openings, the auricular and the opening of the aorta. The *auricular opening* is the larger, and corresponds with the size of the auricle. From its circumference is continued a membranous fold *(cortina tendinea)*, which has commonly two projections, the one opposite to the margo obtusus, and the other opposite to the aortic opening. To this curtain the *chordæ tendineæ* before spoken of are attached, and thus is formed the *bicuspid* or *mitral valve* of the auricular opening. The *opening of the aorta* is situated a little more anteriorly. It has *three semilunar valves,* which resemble those of the pulmonary artery, but are thicker and stronger. Opposite to them are three depressions or enlargements of the aorta, called the *sinuses* (sin. Valsalvæ). In the two anterior sinuses, a little above the edge of the valves, are the openings of the two coronary arteries.

STRUCTURE OF THE HEART. The proper structure of the heart is muscular, its external surface covered by the close portion of the pericardium; and it has a peculiar *lining* of membrane. The muscular fibres composing it cross each other in all directions, but on the exterior assume a more regular disposition. The thickness of the muscular coat varies at different parts: it is thinner in the auricles than in the ventricles: and in the ventricles, it is much thinner on the right side than on the left. It is thick where it forms the septum both of the auricles and ventricles. Between the muscular covering and the pericardium, more or less fat is usually deposited, and it is more abundant generally on the right side, and in the course of the coronary vessels. The membrane which lines the heart gives a smooth and polished surface to the interior of its cavities; it is so thin that, in some parts, it appears to be wanting; but even in these it may be detached in small portions.

CORONARY VESSELS. The two *arteries* so called, and by which the heart is supplied, are the first branches given off by the aorta, and arise from that vessel nearly opposite to the edges of the semilunar valves, as has been already described. They are distinguished by the names of *right* and *left coronary.* The *right,* or anterior, takes its course transversely between the right auricle and ventricle, is continued to the flattened surface of the heart, then passes in the direction of the septum as far as the apex of the heart. It distributes branches in its course, which principally supply the right side. The *left,* or posterior artery, passes downwards, covered by the appendix of the left auricle, to the convex surface of the heart; one branch continuing in the groove between the ventricles, as far as the apex, and anastomosing with the right artery; another branch passing in the groove between the left auricle and ventricle, to the flattened surface of the heart. This left artery distributes branches chiefly to the left side of the heart.

The coronary *veins* accompany the arteries. The greater number uniting form a considerable trunk, which passes between the left auricle and ventricle, and terminates, as has been already described, at the under part of the right auricle. There is generally a smaller vein, which runs upon the right ventricle, and terminates in the appendix of the auricle. Besides these, the blood is supposed to find its way into the cavities of the heart from the blood-vessels by orifices, which are called the *foramina Thebesii.* Their existence has been supposed to be established by the fact, that fluids injected into the coronary vessels are frequently found to make their way into the cavities of the heart.

§ 3. OF THE MUSCLES PARTICULARLY CONNECTED WITH THE RIBS, DISTRIBUTED INTO REGIONS, viz.

a. Intercostal Region, containing the

1. Intercostales Externi.

Origin. From the under edge of each rib, excepting the twelfth; from the spine to the junction of the ribs with their cartilages. From these to the sternum they are discontinued, and their place occupied by an aponeurosis. They pass obliquely downward and forward.

Insertion. Into the upper edge of each rib, immediately below that from which they arise.

2. Intercostales Interni. Their mode of origin and insertion is the same as that of the intercostales externi; but they begin at the sternum, run obliquely downwards and backwards, decussating the *externi,* and are continued only as far as the angle of the ribs.

3. Levatores Costarum. Are portions of the the intercostales externi, which arise from the transverse processes of the vertebræ, and terminate in the ribs immediately below.

4. Depressores Costarum. Are portions of the intercostales interni, which at the lower part of the chest pass over one rib, and are inserted into the next below it.

5. STERNO-COSTALIS. Situated within the thorax.

Origin. From the edge of the cartilage ensiformis, and from the lower half of the middle bone of the sternum. It passes upwards and outwards.

Insertion. Generally into the cartilage of the third, fourth, and fifth ribs, sometimes into that of the second and sixth.

b. LATERAL CERVICAL REGION, containing the

1. SCALENUS ANTICUS.

Origin. From the transverse processes of the fourth, fifth, and sixth cervical vertebræ.

Insertion. Tendinous and fleshy into the upper part of the first rib, near its cartilage.

2. SCALENUS MEDIUS.

Origin. Tendinous from the transverse processes of all the cervical vertebræ.

Insertion. Into the posterior half, upper and outer part of the first rib.

Between the two above muscles, the subclavian artery takes its course, and at that part the scalenus anticus separates the artery from the vein, which runs before that muscle.

3. SCALENUS POSTICUS.

Origin. From the transverse processes of the fifth and sixth cervical vertebræ.

Insertion. Into the upper edge of the second rib, near the spine.

c. VERTEBRO-COSTAL REGION, containing muscles situated on the back, viz.

1. SERRATUS SUPERIOR POSTICUS.

Origin. Tendinous from the spinous processes of the three undermost cervical, and of the two uppermost dorsal, vertebræ.

Insertion. Into the second, third, fourth, and fifth ribs, by as many fleshy slips.

2. SERRATUS INFERIOR POSTICUS.

Origin. Thin and tendinous in common with the latissimus dorsi, from the spinous processes of the two undermost dorsal, and of the three uppermost lumbar, vertebræ.

Insertion. Into the lower edges of the four lowest ribs, by as many fleshy slips.

DIAPHRAGM. As one of the principal muscles of respiration, the diaphragm may be properly considered under the same class with these muscles, and with some others not here enumerated; but its examination must be postponed till the abdomen is dissected.

CHAPTER IV.

Of the Muscles nearest to the Vertebral Column.

Most of the muscles in the immediate neighbourhood of the vertebral column are placed on the posterior part of the trunk. The first which will be described, are those, which principally are concerned in the motions of the head.

a. ANTERIOR DEEP CERVICAL, containing the

1. LONGUS COLLI.

Origin. Tendinous and fleshy from the bodies of the three superior vertebræ of the back laterally, and from the transverse processes of the third, fourth, fifth, and sixth vertebræ of the neck.

Insertion. Into the fore part of the bodies of all the vertebræ of the neck, by as many tendinous and fleshy slips.

2. RECTUS CAPITIS INTERNUS MAJOR.

Origin. From the fore part of the transverse processes of the third, fourth, fifth, and sixth vertebræ of the neck.

Insertion. Into the cuneiform process of the os occipitis.

3. RECTUS CAPITIS INTERNUS MINOR.

Origin. From the fore part of the body of the first vertebra of the neck.

Insertion. Into the cuneiform process of the os occipitis, near the root of its condyloid process.

4. RECTUS CAPITIS LATERALIS.

Origin. From the fore part of the transverse process of the first vertebra of the neck.

Insertion. Into the os occipitis, immediately behind the jugular fossa.

The following are situated on the posterior part of the neck and trunk.

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b. SUPERFICIAL CERVICO-OCCIPITAL REGION, containing the

1. SPLENIUS.

Origin. From the spinous processes of the five inferior cervical, and of the four superior dorsal, vertebræ, and adheres to the ligamentum nuchæ. At the third vertebra of the neck the splenii recede from each other, so that part of the *complexus* muscle is seen.

Insertion. Into the transverse processes of the five superior cervical vertebræ, into the posterior part of the mastoid process, and into the adjoining part of the os occipitis. It is sometimes divided into the splenius capitis, or that portion which is fixed to the head, and into the splenius colli, or that portion which is inserted into the cervical vertebræ.

2. COMPLEXUS.

Origin. From the transverse processes of the four inferior cervical, and of the seven superior dorsal vertebræ, receiving an additional fleshy slip from the spinous process of the first vertebra of the back.

Insertion. Into the protuberance, and part of the arched ridge of the os occipitis.

The portion of this muscle which is situated next to the spinous processes, and has a rounded tendinous intersection, has been sometimes named the *biventer cervicis.*

3. TRACHELO-MASTOIDEUS.

Origin. From the transverse processes of the five undermost cervical, and of the three uppermost dorsal, vertebræ.

Insertion. Tendinous into the back part of the mastoid process.

4. TRANSVERSALIS COLLI.

Origin. From the transverse processes of the five uppermost dorsal vertebræ.

Insertion. Into the transverse processes of all the cervical vertebræ, except the first and last.

c. DEEP CERVICO-OCCIPITAL REGION, containing the

1. RECTUS CAPITIS POSTICUS MAJOR.

Origin. From the spinous process of the second cervical vertebra, and passes obliquely upwards and outwards, growing broader in its ascent.

Insertion. Into the os occipitis.

2. RECTUS CAPITIS POSTICUS MINOR.

Origin. From the protuberance, which answers to a spinous process on the first cervical vertebra.

Insertion. Under the former into the os occipitis near the foramen magnum.

3. OBLIQUUS CAPITIS SUPERIOR.

Origin. From the transverse process of the first cervical vertebra.

Insertion. Into the os occipitis, behind the mastoid process of the temporal bone, and to the outer side of the insertion of the rectus major.

4. OBLIQUUS CAPITIS INFERIOR.

Origin. From the spinous process of the second cervical vertebra.

Insertion. Into the transverse process of the first vertebra of the neck.

d. VERTEBRAL REGION, containing the

1. SACRO-LUMBALIS.

Origin. Tendinous without, and fleshy within, from the side, and all the spinous processes of the os sacrum, from the posterior part of the spine of the ilium, and from all the spinous processes, and from the root of the transverse processes of the lumbar vertebræ.

Insertion. Into the angle of each of the ribs by a long and thin tendon.

From the six or eight inferior ribs arise as many fleshy slips, which terminate in the inner side of this muscle, and are named the *Musculi ad sacro-lumbalem accessorii.* From the upper part of the muscle a fleshy slip, called *cervicalis descendens,* ascends, and is inserted into the transverse processes of the fourth, fifth, and sixth cervical vertebræ.

2. LONGISSIMUS DORSI.

Origin. In common with the sacro-lumbalis.

Insertion. Into the transverse processes of all the dorsal vertebræ, chiefly by small double tendons, and by a tendinous and fleshy slip into the lower edge of all the ribs, excepting the two undermost, near their tubercles.

From the upper part of this muscle a round fleshy slip ascends and joins with the cervicalis descendens.

3. SPINALIS DORSI.

Origin. From the spinous processes of the three undermost dorsal, and of the two uppermost lumbar vertebræ, by as many tendons.

Insertion. Into the spinous processes of the nine uppermost dorsal vertebræ, except the first.

4. SEMISPINALIS COLLI.

Origin. From the transverse processes of the six uppermost dorsal vertebræ, by distinct tendons, and runs obliquely under the complexus.

Insertion. Into the spinous processes of all the cervical vertebræ, except the first and last.

5. SEMISPINALIS DORSI.

Origin. From the transverse processes of the seventh, eighth, ninth, and tenth dorsal vertebræ.

Insertion. Into the spinous processes of the two undermost cervical, and four uppermost dorsal vertebræ, by distinct tendons.

6. MULTIFIDUS SPINÆ.

Origin. From the side and spinous processes of the os sacrum, from the posterior part of the spine of the os ilium, from the articular and transverse processes of all the lumbar vertebræ, and from the transverse processes of all the dorsal, and all the cervical, except the three first, by distinct tendons, which soon become fleshy, and take an oblique direction.

Insertion. By distinct tendons into the spinous processes of all the vertebræ of the loins, of the back, and of the neck, except the first.

7. INTERSPINALES. Are smaller muscles, which are situated between, and attached to the spinous processes of the contiguous vertebræ. They are only distinctly fleshy in the cervical vertebræ, and are five in number. Each arises double from the spinous process of the lower vertebra, and is inserted into the spinous process of the vertebra above. In the dorsal and lumbar vertebræ they are rather small tendons than muscles.

8. INTERTRANSVERSALES. Are similar small fleshy bundles, which pass between the transverse processes of the contiguous vertebræ. Those of the neck consist of six distinct double muscles. There are also four distinct fleshy bundles between the transverse processes of the lumbar vertebræ; but those of the back are rather tendons than muscles.

In the above account of the dorsal muscles their attachments are stated according to the description which has been adopted by most anatomists; but it is necessary to remark that they are subject to frequent varieties, and that they are frequently found to be attached to a fewer or greater number of vertebræ than has been there laid down.

§ 4. TABLE EXHIBITING THE ACTIONS OF THE MUSCLES WHICH PRODUCE THE MOVEMENTS OF THE THORAX, OF THE HEAD, AND OF THE VERTEBRÆ.

1. Motions of the Thorax. They are those which take place during respiration. They consist of the motions in *inspiration*, by which the chest is enlarged in all its dimensions, and by means of which the lungs are filled with air; these are produced by the elevation of the ribs and the descent of the diaphragm: and of the motions of *exspiration*, by which the chest is contracted in all its dimensions, and by means of which the air is again expelled from the lungs; these are produced by the depression of the ribs and the ascent of the diaphragm. The muscles may therefore be arranged, *a.—d.* Muscles of Inspiration, and *b.* Muscles of Exspiration. It is to be observed, however, that the diaphragm is the principal agent both of inspiration and exspiration, and in unconstrained breathing is but feebly assisted by the muscles which move the ribs not excepting even the intercostales. When respiration is carried on with some effort, the intercostal muscles are more exerted: but it is only in laborious breathing that the numerous other muscles attached to the ribs are called into action.

a. Muscles of Inspiration.

1. Diaphragma.
2. Intercostales.
3. Levatores costarum.
4. Depressores costarum.

Assisted occasionally by the

1. Sterno-mastoidei.
2. Scaleni antici.
3. Scaleni medii.
4. Scaleni postici.
5. Serrati postici superiores.
6. Serrati magni.
7. Subclavii,
8. Pectorales majores,
9. Pectorales minores,
10. Latissimi dorsi,

} when the shoulders are fixed.

b. MUSCLES OF EXSPIRATION.

1. Triangularis sterni.
2. Obliqui externi abdominis.
3. Obliqui interni abdominis.
4. Transversi abdominis.
5. Recti abdominis.
6. Pyramidales.

Assisted occasionally by the

7. Serrati postici inferiores.
8. Longissimi dorsi.
9. Sacro-lumbales.
10. Quadrati lumborum.

2. MOTIONS OF THE HEAD AND CERVICAL VERTEBRÆ. There are inflections of the head upon the atlas, but they are very inconsiderable: consisting of *inflections forwards,* which are performed by the, 1. Recti capitis interni minores—2. Recti capitis laterales: of *inflections backward,* which are performed by the, 1. Recti capitis postici minores—2. Obliqui capitis superiores; and of *lateral inflections* by these muscles at the sides. But the principal motions of the head are produced by the inflections of the cervical vertebræ; which may be bent *forwards* or *backwards,* and *to either side,* and give a corresponding inclination to the head. Likewise in consequence of the mode of articulation between the first and second vertebræ, the former, together with the head, may perform a motion of *rotation* upon the latter. Therefore the muscles moving the head and cervical vertebræ may be arranged as—*a.* INFLECTORS FORWARD, *b.* INFLECTORS BACKWARD, *c.* ROTATORS TO THE RIGHT, *d.* ROTATORS TO THE LEFT. It will not be necessary to particularise the muscles which inflect laterally, as all the muscles which are described as inflectors forward and backward, must exert a force in the lateral direction when used only on one side, except those which are situated close to the median plane.

a. INFLECTORS FORWARD.

1. Musculi cutanei.
2. Digastrici,
3. Mylo-hyoidei,
4. Genio-hyoidei,
5. Genio-hyo-glossi,

} when the lower jaw is closed.

6. Omo-hyoidei,
7. Sterno-hyoidei, } by fixing and drawing down
8. Sterno-thyroidei, } the os hyoides.
9. Thyreo-hyoidei,
10. Sterno-mastoidei.
11. Recti capitis interni majores.
12. Longi colli.
13. Scaleni antici.

b. INFLECTORS BACKWARD.

1. Trapezii.
2. Splenii.
3. Complexi.
4. Trachelo-mastoidei.
5. Cervicales descendentes.
6. Transversales colli.
7. Recti capitis postici majores.
8. Obliqui capitis inferiores.
9. Spinales colli.
10. Semispinales colli.
11. Multifidi spinæ.
12. Scaleni postici.

N. B. The *scaleni medii* appear to act exclusively as lateral inflectors.

c. ROTATORS of the head to THE RIGHT.

1. Right musculus cutaneus.
2. Left sterno-mastoideus.
3. Left trapezius.
4. Right splenius.
5. Right complexus.
6. Right rectus capitis posticus major.
7. Right obliquus capitis inferior.
8. Right trachelo-mastoideus.

d. ROTATORS of the head to THE LEFT.

1. Left musculus cutaneus.
2. Right sterno-mastoideus.
3. Right trapezius.
4. Left splenius.
5. Left complexus.
6. Left rectus capitis posticus major.

7. Left obliquus capitis inferior.
8. Left trachelo-mastoideus.

MOTIONS OF THE DORSAL AND LUMBAR VERTEBRÆ. The motions of these vertebræ affect the whole trunk. They consist of *Inflections forward—backward*—and *to either side.* The muscles may be divided into—*a.* INFLECTORS FORWARD, and *b.* INFLECTORS BACKWARD. These, when used only on one side, will exert a force in the lateral direction, and therefore need not be arranged as lateral inflectors.

a. INFLECTORS FORWARD.

1. Pectorales majores,
2. Pectorales minores,
3. Serrati magni,

} when the ribs and shoulders are fixed.

4. Obliqui externi abdominis,
5. Obliqui interni abdominis,
6. Transversi abdominis,
7. Recti abdominis,
8. Pyramidales,

} when the ribs are fixed.

9. Psoæ parvi.
10. Psoæ magni.

b. INFLECTORS BACKWARD.

1. Trapezii,
2. Rhomboidei,
3. Latissimi dorsi,

} when the shoulders are fixed.

4. Serrati postici superiores,
5. Serrati postici inferiores,

} when the ribs are fixed.

6. Sacro-lumbales.
7. Longissimi dorsi.
8. Spinales dorsi.
9. Semispinales dorsi.
10. Multifidi spinæ dorsi et lumborum.
11. Intertransversales lumborum.
12. Quadrati lumborum.

CHAPTER V.

Of the Articulations of the Head, Spine, and Thorax.

§ 1. ARTICULATION OF THE LOWER JAW.

THE articulation has two lateral ligaments; a capsule of synovial membrane, and an interarticular cartilage.

1. **EXTERNAL LATERAL LIGAMENT** (ligamentum maxillæ laterale externum). Consists of strong perpendicular fibres, which arise from the posterior extremity of the zygoma, descend upon the synovial capsule, and are inserted into the outer side of the neck of the lower jaw.

2. **INTERNAL LATERAL LIGAMENT** (ligamentum laterale internum). Consists of a thin tendinous layer which arises from the styloid process of the temporal bone, passes obliquely downwards, outwards, and forwards, and is attached to the lower jaw, below the posterior maxiliary foramen.

3. **SYNOVIAL MEMBRANE.** Forms a double sac, one of which is above and the other below the interarticular cartilage. It is continued above to the edge of the glenoid cavity, and below to the circumference of the condyloid process of the lower jaw, being so united, in the interval, to the interarticular cartilage, that the two cavities have no communication with each other. It is so loose as to admit of considerable and easy movement of the lower jaw.

4. **INTERARTICULAR CARTILAGE.** Is of an oval figure, and is placed horizontally. It is hollowed out both above and below, and is thicker at the circumference than in the centre, and thicker behind than before, so as to adapt its upper surface to the articular eminence and glenoid cavity of the temporal bone.

5. LIGAMENT OF THE JAW AND OS HYOIDES. Besides these ligaments there is a process of condensed cellular membrane intermixed with some ligamentous fibres (ligamentum stylo-mylo-hyoideum) which passes from the extremity of the styloid process to the posterior edge of the angle of the lower jaw, and thence sends a rounded elongation to the appendix of the os hyoides.

§ 2. ARTICULATION OF THE HEAD WITH THE FIRST AND SECOND VERTEBRÆ, AND OF THESE VERTEBRÆ WITH EACH OTHER.

In order to display the connexion of these parts, the head with the first and second vertebræ should be separated from the rest of the spine. The occipital bone should then be cut so as to lay open the foramen magnum behind, and the vertebral canal should be opened by cutting away the back part of the arches of the first and second vertebræ.

The ligaments which connect the occiput to these vertebræ, are

a. BETWEEN THE OCCIPUT AND ATLAS.

1. ANTERIOR LIGAMENT. Is a continuation of the anterior ligament of the spine. It is a broad ligamentous expansion, which is continued from the anterior arch of the atlas to the anterior edge of the foramen magnum.

2. POSTERIOR LIGAMENT. Is a similar broad but thinner ligamentous expansion, which is extended between the posterior arch of the atlas to the posterior edge of the foramen magnum.

3. CAPSULAR OF THE ARTICULAR SURFACES. Each of these surfaces has a synovial membrane, which is strengthened on the exterior by ligamentous fibres.

b. BETWEEN THE OCCIPUT AND THE VERTEBRA DENTATA.

1. PERPENDICULAR LIGAMENT (ligamentum rectum medium). Extends from the point of the dentiform process of the second vertebra to the edge of the foramen magnum. It consists of straight fibres, but which are frequently not very strong nor distinct.

2. **Lateral Ligaments** (ligamenta lateralia). Arise from the sides of the processus dentatus: they pass obliquely upwards and outwards, and are fixed to the inner edge of the foramen magnum. They are short, but strong, and have a rounded form.

c. Of the Atlas.

1. **Transverse Ligament** (ligamentum atlantis transversale). Is composed of transverse fibres, which arise from one side of the atlas, pass across behind the processus dentatus, and are fixed to the opposite side of the atlas. Between it and the dentiform process is a synovial capsule.

The edges of this ligament extend upwards and downwards, and form two processes called its *appendices*, which are fixed to the foramen magnum and processus dentatus.

d. Between the First and Second Vertebra.

The articulating surfaces are connected by loose synovial membranes, which are strengthened on the exterior by ligamentous fibres, which extend between the bones.

§ 3. ARTICULATIONS OF THE VERTEBRÆ IN GENERAL.

1. **Anterior Common Ligament** (ligamentum vertebrarum commune anterius). Is a strong ligamentous band, composed of longitudinal fibres, which extends from the fore part of the foramen magnum along the fore part of the bodies of the vertebræ, and anterior surface of the sacrum as far as the os coccygis. It is thicker upon the fore part of the vertebræ than at the sides, and is more considerable in the middle of the vertebræ than towards the inter-vertebral substance. It is thinnest on the uppermost lumbar and lowermost cervical vertebræ, in order to allow a greater degree of motion of those parts. Besides the perpendicular there are oblique decussating fibres which run between the bodies of the vertebræ upon the intervertebral substance, and are sometimes distinguished by the name of *crucial intervertebral ligaments.*

2. **Posterior Common Ligament** (ligamentum vertebrarum commune posterius). Extends along the posterior surfaces of the bodies of the vertebræ within the vertebral canal, from the foramen magnum to the lower part of the lumbar ver-

tebra. Its breadth diminishes irregularly from above to below. In its descent it becomes broader over each of the intervertebral substances, diminishes between them upon the bodies of the vertebræ, and adheres firmly to their upper and under edges. It prevents the spine from being bent too much forwards.

3. INTERSPINOUS LIGAMENTS. Consist of thin membranous processes, extended between the bodies of the spinous processes, and of small rounded ligaments extended between the extremities of those processes.

4. INTERTRANSVERSE LIGAMENTS. Are small ligaments extended between the transverse processes of the undermost dorsal vertebræ.

5. CERVICAL LIGAMENT (ligamentum nuchæ). Arises from the perpendicular spine of the occipital bone, descends on the back part of the neck, and adheres to the spinous processes of the cervical vertebræ.

6. INTERVERTEBRAL SUBSTANCES. Are the principal means of connexion between the bodies of the vertebræ. They are highly elastic and of a ligamento-cartilaginous structure, and are composed of concentric layers, the edges of which are firmly fixed to the bodies of the vertebræ. The lamellæ are made up of oblique fibres, which decussate each other, and they are united by fibres which pass between them. Between the layers a soft gelatinous and incompressible substance is interposed; it is in small quantity at the circumference, but increases towards the centre; and the centre-part itself consists entirely of this substance, and serves as a pivot for the motions of the spine. The strength of this structure is such, that under injury to the spine it is found that the bone will break sooner than this substance will give way. The intervertebral substances are thicker in the centre than at the circumference, and their thickness increases from above downwards.

7. ELASTIC LIGAMENTS (ligamenta arcuum subflava). The arches of the vertebræ are connected by means of a very elastic and yellowish ligamento-cartilaginous structure. This substance fills up the spaces between the arches, completes the back part of the vertebral canal, and affords a very strong mode of union, but which at the same time admits of a considerable degree of motion.

8. CAPSULES OF THE ARTICULAR PROCESSES.

The surfaces of the articular processes are covered with cartilage, and are provided with capsules of synovial membrane, which are strengthened on the exterior by ligamentous fibres.

§ 4. ARTICULATIONS OF THE RIBS.

a. OF THE RIBS WITH THE VERTEBRÆ.

1. OF THE HEADS (ligamenta capitulorum costarum). The articulating surfaces are received into the cavities formed for them in the two adjoined vertebræ, and are connected by means of a synovial membrane, and by bands of ligamentous fibres which extend on the anterior and posterior part of the joint.

2. CAPSULES OF THE TUBERCLES. Consist of synovial membrane, which connect the articulating surfaces of the tubercles with those of the transverse processes of the vertebræ. They are more loose than those of the heads.

3. EXTERNAL TRANSVERSE LIGAMENTS (ligamenta transversaria costarum externa). Are strong ligamentous bands which arise from the extremity of each transverse process, pass transversely outwards, and are attached to each tubercle.

4. INTERNAL LIGAMENTS OF THE NECK OF THE RIBS (ligamenta cervicis costarum interna). Arise from the lower part of each transverse process, and descending obliquely become fixed to the neck of each rib below that with which the process is connected.

5. EXTERNAL LIGAMENTS OF THE NECK OF THE RIBS (ligamenta cervicis costarum externa). Arise from the transverse processes externally, descend obliquely in an opposite direction to that of the former ligaments, and are attached to the upper and outer part of the necks of the ribs.

b. OF THE RIBS WITH THE STERNUM.

The greater number of the ribs are connected with the sternum either mediately or immediately by means of their cartilages. The cartilage of the first rib is inseparably united with the uppermost bone. Those of the six lower true ribs are adapted by articular surfaces, and are connected by means of capsules of synovial membrane. These are strengthened on the exterior by ligamentous bands, which arise from the extremities of the cartilages, are continued before and behind the articulation, and spread upon the sternum. There are also shining ligamentous bands, which extend upon the cartilages and connect them together.

§ 5. LIGAMENTS OF THE STERNUM.

Membranes of the Sternum (membrana ossium sterni anterior et posterior). Are firm aponeurotic expansions, composed of fibres which run in different directions, but chiefly in a longitudinal one, and cover the anterior and posterior surfaces of the bone.

SECTION THE SECOND.

PART II.

CONTAINING THE DISSECTION OF THE

ABDOMEN AND PELVIS.

CHAPTER I.

Of the Abdomen.

§ 1. OF THE EXTERIOR OF THE ABDOMEN.

MUSCLES, situated on the anterior part of the abdomen, or in the ABDOMINAL REGION. They consist of five pairs, disposed in layers, which form the anterior and lateral parietes of the abdominal cavity.

1. OBLIQUUS EXTERNUS ABDOMINIS (descendens). Forms the first layer. For the purpose of dissecting it, an incision should be carried from the cartilago ensiformis to the os pubis, and a second obliquely downwards and forwards in the course of the fibres, from the margin of the ribs to the first incision.

Origin. By eight heads from the eight inferior ribs, of which the lower are received between the fleshy digitations of the serratus magnus. It is connected above to the pectoralis major, adheres to the intercostales, and is covered below and behind by the latissimus dorsi, where it extends between the last rib and the spine of the ilium. From those attachments the fibres of the muscle run obliquely downwards and forwards, and terminate in a thin broad tendon, the fibres of which are continued in the same direction.

Insertion. By joining with its fellow at the linea alba, which extends from the cartilago ensiformis to the pubes; into the os pubis on the same side on which it arises, and into the opposite os pubis; and into the fore part of the spine of the ilium. The lower part of the tendon is unconnected; extends between the anterior and superior spinous process of the ilium, and the projecting part of the os pubis, near to the symphysis, and forms a strong rounded margin, which does not become distinct until the fascia lata of the thigh, which is connected with it, has been detached: it has been called *Poupart's* or *Fallopius's ligament*, or the *crural arch.* It has also another attachment to the os pubis, which extends from the inner and back part of Poupart's ligament, called *Gimbernat's ligament*, but which cannot be readily seen in this stage of the dissection.

When the external layer, or the external oblique, has been completely dissected, it will be seen that it is fleshy only at the upper part and sides, and that it is tendinous at the lower and anterior part. On the tendinous portion are presented several distinct lines. These are: the *linea alba*, or white line, already mentioned, which extends from the ensiform cartilage to the pubes, and is formed by the intermixture of the tendons of the oblique and transverse muscles: the *linea semilunaris* or semilunar line, so called from its curved direction, which is situated on the outside of the rectus muscle, and is formed by the connexion of the tendon of the external oblique at that part with the tendons of the internal oblique and transverse muscles: and the *lineæ transversales*, so called from their passing transversely between the linea alba and semilunaris. These are produced by the connexion of the tendon of the obliquus externus with the tendinous intersections of the rectus muscle beneath: there are generally three, one opposite to the cartilage of the seventh rib, one opposite to the umbilicus, the third in the middle between these; and there is commonly a half line below the umbilicus.

There are also several openings in the tendon of the obliquus externus. One of these is the *umbilicus*, situated in the middle of the linea alba, originally the passage for the umbilical cord; the second is the *external abdominal ring* or the passage for the spermatic cord in the male, and for the round ligament in the female, which is found on each side extending obliquely upwards and outwards above the spinous process of the os pubis. This latter is not annular in its figure, as its name might imply, but is formed by the separation of the tendinous fibres of the external oblique muscle. The fibres which form the inner margin or column of the ring, generally decussate the corresponding fibres of the opposite side, and are fixed to the opposite os pubis near the symphysis: those which constitute the outer margin or column form a rounded cord, and are attached to the spinous process of the os pubis; the columns above the cord are connected by tendinous fibres, which run transversely. The boundaries of the abdominal ring are not distinctly seen, till a quantity of cellular substance has been removed, which surrounds the cord or round ligament, and assists in filling up the aperture. Besides these openings there are frequently separations of the tendinous fibres at other parts, and small apertures for the passage of blood-vessels and nerves.

2. OBLIQUUS INTERNUS ABDOMINIS (ascendens). Forms the second layer of abdominal muscles. In order to display it, it is necessary to detach the external oblique muscle from the ribs, and from the spine of the ilium, and to reflect it forwards.

Origin. It is united behind with the broad tendon of the latissimus dorsi and serratus posticus inferior, which arises from the spinous processes of the sacrum and of the lumbar vertebræ, and by which therefore it is connected to these parts. It is usually said to arise from the sacrum, and from the spinous processes of the three lowest lumbar vertebræ. It is connected at the back part of the abdomen with the tendon of the transverse muscle. It arises also from the whole length of the spine of the ilium, and from the outer half of Poupart's ligament internally. From these origins the fibres of the muscle spread somewhat like a fan on the side of the abdomen, the superior run obliquely upwards, the middle pass nearly transversely, and the lowest are continued obliquely downwards and forwards towards the os pubis. The fleshy fibres terminate anteriorly in a broad tendon, which passes behind the tendon of the external oblique to the edge of the rectus, and there splits into two layers, one of which passes before and the other behind the rectus muscle. The lowest fourth of the posterior layer is not, however, continued behind the rectus, but passes with the anterior layer before that muscle. The posterior layer should not be examined until after the rectus has been dissected.

Insertion. Into the ensiform cartilage, and into the cartilages of the six lowest ribs; but the tendon at the upper part is extremely thin, and resembles cellular membrane. It is connected to the whole length of the linea alba, and is inserted below into the os pubis.

From the lower edge of this muscle arise some pale fibres which pass upon the cord, and assist in forming the *Cremaster muscle.*

3. TRANSVERSALIS ABDOMINIS. Forms the third layer of abdominal muscles. It is displayed by reflecting

the internal oblique from its attachments to the cartilages of the ribs, to the tendon of the latissimus dorsi, and the spine of the ilium.

Origin. Fleshy from the cartilages of the seven lowest ribs internally, where it intermixes with the diaphragm and intercostal muscles: by a broad tendon from the transverse processes of the twelfth dorsal, and four superior lumbar, vertebræ; from the inner labium of the spine of the ilium, and from the outer half of Poupart's ligament. At this part the muscle is intimately connected with the *Internal Oblique*. The fibres pass transversely forwards, and terminate in a broad tendon, which, except the lower portion, is continued behind the rectus muscle. The lower portion joins with that of the internal oblique, and passes before the rectus; there are, however, some fibres observed behind the rectus.

Insertion. Into the ensiform cartilage: into the whole length of the linea alba, and into the os pubis.

Some of the fibres of the *Cremaster muscle* are derived also from this muscle. The spermatic cord, or round ligament, passes obliquely under the edges of the internal oblique, and the transverse muscle.

If the lower portion of the transverse muscle be raised from the ilium and Poupart's ligament, it will be found lined posteriorly by an aponeurosis, which has been called by Mr. A. Cooper, the *fascia transversalis;* and in tracing this fascia towards the pubes, an aperture, called the *internal abdominal ring* will be discovered in it about midway, between the anterior and superior spinous process of the ilium, and spinous process of the os pubis, forming the passage of the spermatic vessels and vas deferens. The dissection of these parts is connected with the anatomy of hernia; and in consequence of their importance, a more accurate and detailed account of their structure will be found in Section IV. of this work.

4. Rectus Abdominis. Is situated on the fore part of the abdomen, between the linea alba and linea semilunaris. It is contained in a sheath, which is formed, on the fore part, by the tendon of the external oblique, and by the anterior layer of the tendon of the internal oblique; and, on the back part, by the posterior layer of the tendon of the internal oblique and by the tendon of the transverse muscle. This sheath should not be examined till the muscle has been dissected. The fore part of the sheath is now to be divided down its middle from above to below, and is to be separated from the surface of the muscle.

Origin. From the cartilages of the three lowest true ribs, and descends by the side of the linea alba. It has tendinous intersections, as has been already noticed, of which there are three usually compleat, and a fourth that is continued only half across the muscle. They vary, however, in number, and seldom penetrate through the whole thickness of the muscle. They adhere firmly to the anterior part of the sheath.

Insertion. By a short flattened tendon into the os pubis, near the symphysis.

5. **Pyramidalis.** Is frequently wanting on one or both sides.

Origin. Broad from the os pubis, near the symphysis. It runs up along the inner edge of the rectus muscle, covered by the anterior part of the sheath of the rectus, and gradually contracting its breadth.

Insertion. Tendinous, into the linea alba, about mid-way between the umbilicus and pubes.

The *sheath of the rectus* may now be examined, by cutting the muscle across the middle, and reflecting the divided portions from the subjacent parts. It will be seen that the tendon of the internal oblique splits into two layers, one of which passes before the muscle with the tendon of the external oblique, and the other passes behind the same with the tendon of the transversalis: except at the lower part, where from the pubes to about midway between the pubes and umbilicus, the posterior layers also pass before the muscle, leaving the back part of the sheath incompleat.

§ 2. OF THE CONTENTS OF THE ABDOMEN.

The Abdomen is the second inferior and larger cavity of the trunk. It contains the organs which are subservient to the digestive process, or the *chylopoietic viscera;* the *urinary organs* which secrete, retain, and convey the urine; and a part of the *organs of generation.*

The parietes of the cavity are formed by the lumbar vertebræ, the bones of the pelvis, the cartilages and ligaments belonging to them, the lumbar mass of muscles, the five pair of abdominal muscles, and the muscles at the outlet of the pelvis.

Regions of the Abdomen. The abdomen is arbitrarily divided into different regions. 1. The **Epigastric,** which is all that part situated above a line which is drawn from the last rib on one side transversely to that on the opposite side. This again is subdivided—into a middle region, called the *scrobiculus cordis,* bounded at the sides by the edges of the cartilages of the ribs, and, superiorly, by the cartilago xiphoides; and into two lateral regions, covered by the cartilages of the ribs, and hence called the *hypochondriac*. 2. The UMBILICAL, which is bounded, above, by the transverse line between the extremities of the last ribs, and, below, by one drawn between the anterior and superior spinous processes of the ilia. This likewise is subdivided into three others by a line drawn on each side perpendicularly upwards from the anterior and superior spinous processes to the line bounding this region superiorly: the middle space retains the name of *umbilical*, the lateral spaces are called the *iliac regions*. 3. The HYPOGASTRIC REGION, which comprises the inferior and remaining part of the abdomen. It is bounded, above by the line between the anterior and superior spinous processes of the ilia; and below by the pubes and groins. Its subdivision is supposed by a line on each side drawn perpendicularly upwards from the spinous processes of the pubes to the upper boundary: the middle space is called the pubes, or *pubic* region; the lateral regions are called the *inguinal*. 4. The LUMBAR: the posterior part of the abdomen between the ribs and ilia is divided in the right and left *lumbar* regions.

PERITONÆUM. The abdominal muscles may next be carefully dissected off, to the extent of a few inches about the umbilicus; and this will enable us to display as far as is necessary the thin membrane, called the peritonæum, which lines the parietes of the abdomen, and gives a covering to its contents. Interposed between the muscles and the peritonæum, we shall find the remains of the umbilical vessels which convey the blood to and from the fœtus in utero, and are called the *ligaments of the peritonæum.* They consist of—the remains of the umbilical vein which passes upwards from the umbilicus, and may be traced to the liver; the remains of the two umbilical arteries which pass downwards from the umbilicus, and terminate at the internal iliac arteries; to which add the urachus, which in the human subject is nothing more than a cord (in some instances an imperfect canal) passing downwards towards the bladder.

The cavity of the abdomen is next to be laid open by one incision, which is to be carried from below the cartilago ensiformis to the pubes, and by two lateral incisions which are extended from the umbilicus to the crista of the ilium on each side.

The *peritonæum*, like the pleura and pericardium, (*see* p. 114) is a membrane of the reflected kind. After lining the parietes it is reflected from them, covering the different viscera and their vessels, contained within the abdomen, and assists in retaining them in their situation. It is without any opening, so that if it could be raised from the viscera which it envelopes, and from all the parts to which it is attached, it would form a large bag, and it would be seen that the viscera are in appearance only contained within it.

The external surface, by means of which it is attached to the parts it covers, is of a loose cellular texture.

Its internal surface is smooth, and without any attachment; and allows therefore of motion between the viscera and parietes. It is moistened by a secretion from its internal surface, which in the dead subject is condensed into a clear serous fluid. The peritonæum is semi-transparent and thin, but of considerable firmness. Its structure, which may be demonstrated by maceration, consists of pale, delicate membranous filaments matted together, resembling the structure of the other serous membranes.

SITUATION OF THE CHYLOPOIETIC VISCERA.

On opening the abdomen anteriorly, four parts come into view: the stomach, the liver, a portion of the gall-bladder, and the omentum: and if the omentum be short, the small intestines are in part seen.

Liver. Occupies nearly the whole of the right hypochondrium; and crossing the scrobiculus cordis extends a little into the left hypochondrium. Its anterior edge is situated immediately behind the edge of the cartilages of the ribs.

Stomach. Is situated at the upper and left part of the abdomen. It is a muscular bag, which is capacious and rounded at one extremity, and gradually decreases to the opposite. It is the continuation of the alimentary canal between the extremity of the œsophagus and the beginning of the intestines. It occupies nearly the whole of the left hypochondrium, and extends into the epigastrium.

It is divided externally into two surfaces, an *anterior* and a *posterior*; two curvatures, a *greater* and a *less*; and two extremities, a *right* and *left*, or cardiac and pyloric. It has likewise two openings formed by the cardia and pylorus, and called the *cardiac* and *pyloric orifices*. The greater curvature is convex, forms the inferior edge, and reaches from one extremity to the other; and a process of the peritonæum is attached to it. The lesser curvature is concave, and is comprehended between the pyloric and cardiac orifices; the peritonæum is attached in the same way as to the greater. The left extremity comprehends all that portion of the stomach which is to the left of the œsophagus: it forms a large cul-de-sac below the cardiac orifice. The cardiac opening forms the communication with the œsophagus; and is situated higher and more posteriorly than the pyloric orifice. The situation of the pyloric orifice, which forms the communication with the intestines, is marked by a circular depression and a sensible thickening. It is lower, and more forwards than the cardiac orifice. The direction of the stomach is transverse, but with such a degree of obliquity that the anterior surface is higher than the posterior; the left extremity higher and more posterior than the right; and the lesser curvature posterior to, at the same time that it is higher than, the greater.

COURSE OF THE INTESTINES. Under the name of INTESTINAL CANAL, or intestines, we designate the muscular and membranous tube, beginning at the pylorus and terminating at the anus. It forms numerous turns and circumvolutions in the abdomen. Its length in the adult is in general six or seven times the length of the whole body. The intestinal canal is smaller at the upper part than at the lower, and in consequence has been divided into *large* and *small intestines,* each subdivided into three portions: the small into,—1. DUODENUM,—2. JEJUNUM, and 3. ILIUM: the large into,—1. COLON, 2. CŒCUM, and 3. RECTUM.

On turning up the omentum, the convolutions of the small intestines are seen, occupying a large portion of the abdomen; while a considerable part of the large will be observed to pass around them.

DUODENUM. So named from being about the length of twelve fingers' breadths; extends from the pylorus to the transverse mesocolon, forming a curve, of which the convexity is to the right, the concavity to the left; takes its course from the pylorus horizontally backwards, and to the right as far as the neck of the gall-bladder; then turns downwards in a curved direction to the left, surrounding the head of the pancreas, as far as the second lumbar vertebra; and lastly is continued transversely to the left, passing before the spine, and behind the root of the mesentery and mesocolon, by which it is fixed.

JEJUNUM AND ILIUM. The rest of the intestinal canal, belonging to the division of the small intestines, commences at the termination of the duodenum, at the root of the mesentery and mesocolon, and is extended to the large intestines. It forms numerous and closely contiguous circumvolutions, encircled by the large intestines.

The direction, taken from the origin of this portion of the intestinal canal to the termination, together with its folds of peritonæum, is obliquely from above to below, and from the left to the right. The principal circumvolutions have their convexity anteriorly towards the parietes, their concavity to the spine. They are distinguished by anatomists into *jejunum* (so called from being commonly found empty), and *ilium* (named from its turns): their extent is determined by measurement, two-fifths being assigned to the jejunum and three-fifths to the ilium. The division, however, does not seem to have any natural foundation nor practical utility. The ilium terminates in the large intestines in the right iliac regions, passing rather transversely, whilst the colon and cœcum are placed nearly perpendicularly.

MESENTERY. The small intestines are attached to the parietes by means of the *mesentery*. It is composed of two layers of peritonæum, which pass off from the posterior wall of the abdomen in an oblique line, from about the second lumbar vertebra to the iliac fossa. This attachment is straight and narrow, that towards the intestines is convex, broad, and co-extensive with their length. The mesentery is narrow above, broad in the middle, and then becomes again gradually narrower towards the union of the ilium and cœcum. The two layers, like those of the other doublings of the peritonæum, are connected by a somewhat loose cellular membrane, containing some fat; and between them are situated the absorbent vessels and glands, and the blood-vessels of the intestines.

CŒCUM. So named from its forming a pouch or blind extremity. Is the first of the large intestines, occupying nearly the whole of the hollow of the right ilium, and attached to the iliacus muscle. It is situated below the colon, with which its superior part is continuous, and comprises all that portion which is below the entrance of the ilium. In this situation it is firmly fixed by the peritonæum.

COLON. It retains the Greek name, signifying intestine, and meaning any thing hollow. It passes upwards in the right lumbar region as high as the liver and gall-bladder; it then changes its direction and passes transversely across the abdomen, over to the left side; it descends in the left lumbar region as low as the left iliac fossa; it then forms a turn of an S figure, and at the base of the sacrum becomes rectum. From thus changing its direction it has been divided into four portions:—1. *Ascending Colon,* 2. *Transverse Arch of the Colon,* 3. *Descending Colon,* 4. *Sigmoid Flexure of the Colon.*

The ASCENDING COLON is situated in the right lumbar region above the cœcum, below the gall-bladder; it is covered anteriorly by peritonæum, and is connected posteriorly with the quadratus lumborum and right kidney, by a quantity of cellular membrane. Sometimes, however, it is more loosely connected by the peritonæum passing completely round, and being continued between it and the parietes; in which case, the portion forming the attachment is called the *right lumbar mesocolon,* or the *right ligament of the colon:* this fold is continuous above with the transverse mesocolon, and terminates below behind the cœcum.

THE ARCH OF THE COLON occupies the lower and anterior part of the epigastric region; it is situated usually below the stomach, but passes across the abdomen, sometimes opposite to the navel, and sometimes lower, through the hypogastric region, and behind the anterior layer of the great omentum. It is the longest and largest portion of the divisions of the colon. It is united behind with the *transverse mesocolon.* This is a fold of peritonæum formed of two layers which pass transversely, and connect the colon with the posterior wall of the abdomen; it forms with the intestines a kind of partition of the abdominal cavity. Its figure is semicircular, being larger in the middle than at the sides, where the intestine is near to the parietes. Its inferior layer is continued with the mesentery, its superior passes over the pancreas and third turn of the duodenum, where they separate. On the left it is continued with the peritonæum of the parietes at the eleventh or twelfth rib, forming a fold below the spleen. On the right it is continued to the lumbar peritonæum above the kidney and behind the liver, to the right of the duodenum. The covering of the upper part of the duodenum is a continuation of the superior layer; but where the intestine passes across the spine, it is included between the two layers.

THE DESCENDING COLON. Before the left kidney and below the spleen; having the same relative situation, size, and connexions as the right; it has sometimes a *left mesocolon.*

THE SIGMOID FLEXURE OF THE COLON. Situated in the left iliac fossa, is loosely attached by a double layer of peritonæum, called the *iliac mesocolon.*

RECTUM. Occupies the posterior part of the pelvis. Its name is not correct in the human subject, as it is somewhat curved. At the superior opening of the pelvis it corresponds to the left psoas, is then inclined to the right, passes on the median line, at the lower part of its course, and terminates at the anus. It is covered and fixed by peritonæum, the extent of which will be seen in the dissection of the pelvis: it is sometimes continued behind the intestine; and forms a loose fold called the *mesorectum.* We next proceed to the Omenta.

OMENTA. Of these there are two, a greater and a less.

LESS OMENTUM (oment. gastro-hepaticum, membrana macilentior). Extends between the lesser curvature of the stomach and the concave surface of the liver; it is fixed besides to the extremity of the œsophagus and to the diaphragm, the pylorus, and the commencement of the duodenum. It is placed before the lobulus Spigelii, which may be seen through it: and is composed of two layers of peritonæum, closely applied to each other, and connected by a very fine cellular membrane. Between these layers, at the right extremity, are situated the hepatic vessels and biliary ducts: and this is the part which is called *the capsule of Glisson.* Behind Glisson's capsule is a rounded opening called the *foramen of Winslow.* To prevent the mistake, to which the equivocal import of the word, foramen, might lead, it may be well to notice, that it is a mere aperture of communication between the general cavity of the peritonæum, and a lesser cavity, formed in part by the bag of the omentum.

GREAT OMENTUM (oment. gastro-colicum, membrana adiposa.) Is a bag attached at the upper part anteriorly to the greater curvature of the stomach, and posteriorly to the transverse arch of the colon. If a blow-pipe be introduced into the foramen of Winslow, the bag of the omentum may be inflated, unless (which is not uncommonly the case) adhesions have been formed. From these attachments it extends downwards, between the convolutions of the small intestines and the parietes of the abdomen, covering the former more or less. It varies in size, in the adult often reaching into the pelvis. It is of a quadrilateral figure, and terminates below in a loose edge; to the right it is continued with the colic epiploon, to the left with the covering of the spleen and pancreas. It is formed of two layers of peritonæum; those which have been described as forming the little omentum separate at the less curvature of the stomach, the one passing before that viscus, the other behind; and at the greater curvature of the stomach they again become applied to each other, descend before the small intestines, are reflected upwards to the arch of the colon, where they separate to inclose it, after which they pass together to the spine, forming the transverse mesocolon and the lower boundary of the posterior cavity of the peritonæum. The two layers are connected by cellular membrane, which in the adult and in advanced age generally contains fat. In the young subject it is disposed in the course of the vessels, but afterwards becomes more uniformly diffused.

There is sometimes another fold of peritonæum, distinct; which is called *colic epiploon* (omentum colicum). It is placed on the right side at the angle of union of the right with the transverse mesocolon. It is formed of two layers, and is merely an appendage of the peritonæal coat of the colon.

SPLEEN. The spleen is a spongy body of a purple livid hue, and of an oval figure, situated deeply in the left hypochondrium between the false ribs and stomach, below the diaphragm, above the colon and left kidney. It is connected to the diaphragm and to the left extremity of the stomach by a continuation of the peritonæum.

PANCREAS. It is best seen by tearing through the omentum. The pancreas is a conglomerate gland, situated in the posterior part of the epigastric region, nearly on a level with the twelfth dorsal vertebra; behind the stomach; above the transverse portion of duodenum, and before the vertebral column, the pillars of the diaphragm, and the aorta and vena cava. It is covered by a continuation of the superior layer of the transverse mesocolon. It passes transversely between the inferior portion of the spleen and the second turn of the duodenum, to the latter of which it is attached.

REFLECTION OF THE PERITONÆUM. The situation of the viscera having been observed, the peritonæum may now be successively traced over those parts to which it gives a covering. As it forms a circumscribed cavity, it is immaterial at what part we commence, provided we trace it to the same point. The peritonæum, after quitting the lower part of the recti muscles, is continued over the fundus and posterior surface of the bladder: then passes on to the rectum, and is extended at the sides to the parietes of the pelvis. From the rectum it is continued onwards to the lumbar vertebræ; on the right side it covers the cœcum, and on the left incloses and attaches the sigmoid flexure of the colon. From the lumbar vertebræ it extends to the small intestines, forming the inferior or posterior layer of the mesentery; it passes round the small intestines, and returns to the spine, forming the superior or anterior layer of the mesentery. At the sides it passes before the kidney, and around the ascending and descending portions of the colon. After completing the mesentery it again quits the spine and appears as the posterior or inferior layer of the transverse mesocolon. The anterior or superior layer of the mesocolon is a continuation of the peritonæum from above: the two layers of the mesocolon pass to the colon, separate and inclose that intestine, and then again united pass down as the posterior part of the bag of the omentum, and are reflected upwards as far as the greater curvature of the stomach, forming the anterior part of the bag of the omentum. At the greater curvature of the stomach the two layers again separate; one passes over the anterior, and the other over the posterior surface of the stomach: at the lesser curvature they are connected, and, passing upwards to the concave surface of the liver, constitute the lesser omentum. The layers of the lesser omentum then separate: the posterior is continued over the posterior part of the concave surface of the liver, descends over the posterior wall of the abdomen and pancreas, and is continued with the upper layer of the transverse mesocolon: the anterior is continued over the anterior part of the concave surface of the liver, passes round its edge, covers its convex surface, and is reflected from it so as to form the processes called the ligaments of the liver; it then lines the concave surface of the diaphragm, descends over the fore part of the parietes of the abdomen, and is continued below with that part at which the tracing commenced; namely, at the lower part of the recti muscles.

CONTENTS OF GLISSON'S CAPSULE May now be dissected by cutting through the peritonæum and clearing away the cellular membrane. They consist of the trunks of the hepatic artery, the vena portæ, the biliary ducts with the nerves and absorbent vessels and glands of the liver; intermixed with cellular substance. The *hepatic artery* is situated on the left, the *vena portæ* on the right, with the biliary ducts before it, consisting of the *ductus hepaticus,* which passes down from the liver; the *ductus cysticus,* which is continued from the neck of the gall-bladder; and the *ductus communis choledochus,* which is formed by the union of the two. The nerves and lymphatics surround the great vessels.

STRUCTURE OF THE ALIMENTARY CANAL.

ŒSOPHAGUS. Its course has been already seen in the neck and posterior mediastinum. It begins in the neck about the fourth or fifth cervical vertebra, and terminates at the cardia of the stomach, after having passed through the diaphragm.

It is formed of two tunics, a muscular and a membranous. The *muscular* is composed of two layers, an external, consisting of longitudinal fibres, which begin at the cricoid cartilage, are continued parallel to each other, and ultimately pass upon the stomach, where they become paler and diverge; and an internal one of transverse fibres, connected by delicate cellular membrane to the former. These are fewer than those of the former, and pass circularly around the œsophagus. The *membranous* has the structure of mucous membranes, and numerous follicles for the secretion of mucus. It is distinguished by its paler appearance from the membranes of the pharynx and stomach, has numerous longitudinal plicæ, arising from the contraction of the transverse fibres, but disappearing when it is distended; and is lined by cuticle, which may be seen to terminate in a fringed extremity at the cardiac orifice of the stomach.

STOMACH. The stomach has been compared in figure to the bag of the bag-pipe. Its situation, position, and anatomical division, have been already described. It has three coats: 1. peritonæal, 2. muscular, and 3. villous. 1. The *peritonæal* is a continuation of the peritonæum; two layers from the porta of the liver, after forming the little omentum, separate, and cover the anterior and posterior surfaces of the stomach: these, at the greater curvature re-uniting, form the great omentum. 2. The *muscular coat* is the most considerable. It is composed chiefly of two orders of fibres, a longitudinal and a transverse. The longitudinal fibres take the course of the long diameter of the stomach, and seem to be chiefly continued from the œsophagus; they diverge at the cardiac orifice, and divide into different bundles, the most considerable passing along the less curvature, others descending upon the left extremity and taking the course of the greater curvature throughout its extent, whilst some, but fewer, pass upon the surfaces, intersecting obliquely the circular fibres. The circular order is more considerable: the fibres are few at the cardiac portion of the stomach, but are many and well marked at other parts, especially in the middle: they are arranged parallel to each other, and appear to consist of segments of circles, rather than compleat rings. 3. The third coat, the *villous*, or mucous, is a continuation of the lining membrane of the œsophagus, but differs from it in the minute projections which cover its surface, and from their resemblance to the pile of velvet, have given a name to the coat. It is of a reddish yellow colour, but sometimes the red appearance is so distinct, or inclining to purple, that much caution is requisite, especially where there is a suspicion of poison, before we can decide with safety that it has been produced by inflammation. This coat is frequently found disposed in folds from the contraction of the muscular fibres. Most of these are longitudinal, some are transverse, and at the cardia they are radiated. It is connected with the muscular coat by a fine dense cellular membrane, which has been erroneously described as an expansion of nerve, and called the nervous coat of the stomach.

At the pyloric orifice is situated the *pylorus*, a kind of valve, corresponding to the external depression. It has the form of a broad flat ring, fixed by its circumference, which is thick, to the parietes of the stomach, and forming a round aperture by its internal thin edge. It is composed of a doubling of the mucous membrane, which incloses a bundle of muscular fibres, cellular texture, and a process of a substance, so dense as to resemble cartilage, and which gives firmness to the projection. This valve shuts the stomach, during digestion, and prevents the too early passage of the food.

INTESTINES. In order to examine the structure of the intestines, it will be found most convenient to remove them. They may be divided above, at the commencement of the jejunum, leaving the duodenum untouched, and below at the termination of the colon, after having applied two ligatures round the intestine at each part, and divided between. In dissecting them out of the abdomen, it should be done carefully, so as not to destroy more than is necessary: and in order to this, we should divide only the processes of peritonæum, by which they are retained. Portions then may be separated for dissection, viz. a part of the ilium for the structure of the small intestines, a portion of the arch of the colon for the structure of the large intestines; and the termination of the ilium, and the beginning of the colon and cœcum, in one piece, for the examination of the valve at that part. These portions are to be washed and inflated, and that which is reserved for the dissection of the valve dried.

SMALL INTESTINES. Their structure is similar to that of the stomach. They are cylindrical, and present a smooth and even surface externally. The external or *peritonæal* coat is a continuation of the peritonæum. It closely invests the intestines, except at the posterior part where the mesentery begins. At that part it is rather loosely connected by cellular membrane, but over the whole of the rest of the surface is intimately united by fine cellular membrane to the muscular coat. The *muscular coat* is composed of two sets of fibres: an external, in which the fibres are disposed longitudinally, are very minute, and most distinct on the convexity of the intestine; and an internal, consisting of transverse fibres, which form segments of circles, are stronger, distincter and more numerous than the longitudinal, and encompass the canal. The *villous*, or mucous *coat*, of the intestines presents the same appearance of villi as the internal membrane of the stomach, of which it is a continuation. It forms numerous duplicatures within the canal, called *valvulæ conniventes:* these are fixed transversely to the circumference of the intestine. They vary in breadth and length, but none of them form entire circles; and they are broader in the middle than at the end. The mucous coat is united to the muscular by a cellular texture, which was formerly called the nervous coat. The villi are more conspicuous than in the stomach; they are composed of arteries, veins, and nerves, and the mouths of the absorbent or lacteal vessels. In the cellular texture are found small round and oval glands of the follicular kind; but which are not distinct, except under disease. Some of these are clustered together, whilst others are met with singly; they have, therefore, according to these circumstances, been called the *glandulæ aggregatæ et solitariæ*, or from their discoverers, Brunneri et Peyeri.

Duodenum. Is the largest, and seems capable of the greatest dilatation: whence it has been sometimes called a secondary stomach. It is closely fixed, especially its two lower portions, which give attachment to the pancreas. Its peritonæal covering is partial, being covered only anteriorly by the superior layer of the mesocolon, between the layers of which its transverse portion is included. Its muscular coat is stronger. Its villous coat presents a number of valvulæ conniventes; they begin about an inch from the pyloric orifice. Where the intestine becomes transverse, the ductus communis choledochus, and ductus pancreaticus, terminate upon the internal surface by a common orifice.

Jejunum. It differs from the duodenum in being less, and in having a weaker muscular coat; while the valvulæ conniventes, villi, and lacteals are much more conspicuous as well as more numerous.

Ilium. It is still less in diameter; its coats are thinner; the valvulæ conniventes fewer and smaller; and the lacteals not so numerous.

Large Intestines. Their surface is not even, but disposed in different eminences. To different parts are attached the *appendices pinguedinosæ* or *epiploicæ*. These are small processes, formed of elongations of the peritonæal covering, which contain some cellular membrane and adipose matter. They are sometimes placed in one or two rows, and in other instances are disposed without regularity; but generally are attached to the projecting parts of the intestines. The large intestines are composed of the same coats as the small intestines. The *peritonæal* covering is, for the most part, not so compleat as that of the small. The *muscular* coat is thicker and stronger, and is composed of longitudinal and circular fibres. The circular have the same disposition as in the small intestines. But the longitudinal differ in length and disposition; they are collected together in three different bands, intermixed with tendinous fibres, (commonly called *bands of the colon*). These bands, two of which are anterior, and one posterior, begin at the vermiform process of the cœcum, are continued the whole length of the colon, and are lost upon the rectum. They are shorter than the intestines, and therefore the colon and cœcum seem to be contracted, so as to give externally the appearance of eminences, and internally that of cells. The villous appearance of the internal membrane is much less distinct. The mucous glands are more numerous than in the small intestines.

CŒCUM. The peritonæal covering is seldom complete at the part where the intestine is connected with the psoas and iliacus. To the right and posteriorly we find the *appendix vermiformis*. It is about the size of a large quill, and generally from two to three inches in length; is smooth externally, and enveloped in a proper covering of peritonæum. Its parietes are the same as those of the intestines, its cavity therefore inconsiderable. It terminates in a blind extremity. Its muscular coat is chiefly composed of longitudinal fibres, and its mucous membrane is continued from the cœcum.

VALVE OF THE ILIUM (valve of the colon; ilio-cœcal, ilio-colic valve, &c.). At the place where the ilium terminates in the cœcum and colon, there is a valve, to prevent the passage of the food from the large to the small intestines. If observed in a recent intestine, it appears like a rounded projection into the cavity of the large intestine; with a fissure in its middle, forming two lips, which are united at the extremities, are continued by folds on each side, and are insensibly lost on the sides of the intestine. If the cœcum be removed from the body, with the termination of the ilium and the beginning of the colon, and these inflated and dried; and if then an opening be made opposite to the termination of the ilium, it will be found formed of two semilunar flaps, which adhere by their convex edge to the termination of the ilium and to the parietes of the cœcum and colon, whilst their concave edges project unattached into the cavity. They are united at the extremities, and lost upon the parietes, as before stated. These two folds bound the orifice of the ilium; the inferior being the larger. The valve is formed by a projection of the internal membrane of the ilium doubled upon itself, and then continued with that of the cœcum and colon. Within this, chiefly in the inferior flap, are found some muscular fibres, of the circular order. The peritonæal covering does not enter into its structure, and, if it be cut through, the ilium may be drawn from the large intestines, so as to demonstrate the structure of the valve, while we deprive it of its valvular form. Within the folds that form the lips are some whitish firm fibres of a tendinous structure, called the *retinacula* or fræna Morgagni.

COLON. It has the same structure and appearance as the cœcum. Its peritonæal covering is seldom found complete on the ascending and descending portions.

RECTUM. It will be examined most conveniently after the dissection of the pelvis. It is cylindrical: not so capacious as the colon, but occasionally found exceedingly enlarged from accumulated fæces; and it is always somewhat larger just above the anus. Its external surface does not present the eminences of the colon, for the longitudinal fibres are equally dispersed and not collected in fasciculi. The *peritonæal* covering is most often defective at the posterior part of the rectum, and, in its lowest third, is wholly wanting. This covering is liable to vary from the varying size of the surrounding organs: thus it will be less covered under the enlarged state of the uterus, and in some degree under excessive distension of the bladder. The *muscular* coat is considerably thicker and stronger, the longitudinal fibres are *spread* over the intestine (not collected in fasciculi), and are lost towards the extremity. On the other hand, the circular are particularly strong towards the extremity (sometimes called, internal sphincter). The *mucous* coat is somewhat thicker and redder; its internal surface is disposed in longitudinal and transverse folds (columns of the rectum), the most remarkable of which are at the inferior part. These folds are caused by the contraction of the circular fibres. The mucous glands are found in greater abundance.

OF THE LIVER.

The liver may first be examined *in situ*, in order to become acquainted with its attachments. These are called the *ligaments of the liver*, which are, except the round ligament, productions of the peritonæum:—The *suspensory ligament* consists of two layers of peritonæum, which pass from before to behind, and are continued from the diaphragm to the convex surface of the liver, so as to divide it into right and left portions. At its anterior edge, between its layers, are contained the remains of the umbilical vein, which thus passes to the liver on the exterior of the peritonæum: it is called the *round ligament.* The layers of the suspensory ligament separate from each other behind, leaving a triangular space filled by cellular membrane, and, at this part, are called, the *coronary ligament:* while under the name of the *right* and *left lateral ligaments,* they are continued on each side along the posterior margin of the liver, and connect it to the diaphragm.

The liver may now be taken out, by cutting through the ligaments, and through the ductus communis choledochus, leaving still the duodenum and pancreas *in situ.*

The liver is the largest gland in the body; of a dusky red colour; its average weight, in adults, about three pounds; its figure irregular; and its *superior surface* convex, fitting the concavity of the diaphragm. This surface is divided by the suspensory ligament into two unequal parts; that to the right called the right or great lobe—that to the left, the left or small lobe. The inferior surface is of less extent than the upper; irregularly concave, and rendered unequal by different cavities and projections. These are:—1. To the left, a slightly concave surface, corresponding to the stomach. 2. The *fossa umbilicalis,* or great fissure, dividing the under surface into the right and left lobes, passes from the anterior to the posterior edge. It is often crossed anteriorly by a process of the liver (thence named, *pons hepatis*), so as to render a part of it a complete canal. It lodges anteriorly the umbilical vein, and contains posteriorly the canalis venosus: both of which are of a ligamentous texture. 3. The *porta,* or sulcus transversus, which is not so long as the last, passes from left to right in the direction of the long diameter of the liver, of which it occupies about the middle third. It is situated at nearly an equal distance from the anterior and posterior edges of the viscus, and at right angles with the last fissure. Its depth is considerable, especially in the middle. It contains the trunk of the vena portæ, the principal branches of the hepatic artery, the biliary ducts where they form the ductus hepaticus, and the nerves and absorbents of the liver: these are united by a close cellular membrane. 4. The eminences of the porta, which are two in number; the one, the *lobulus quadratus,* so named from its figure, which bounds anteriorly the porta, and separates the anterior half of the longitudinal or great fissure from the depression in which the gall-bladder rests. The second is called the *lobulus Spigelii;* is more considerable than the last, and is seen through the little omentum. It varies in figure, but is generally of a triangular or quadrilateral form. It bounds the porta posteriorly. Two processes extend from it; one, called the *lobulus caudatus*, extending on the surface of the larger lobe, and separating two depressions afterward to be spoken of; while the other extends to the posterior margin, and assists in forming a canal or depression for the passage of the vena cava inferior. 5. A superficial oval depression, on which part of the gall-bladder lodges, situated to the right of the lobulus quadratus, and without peritonæum. 6. Two less depressions on the right lobe, the anterior answering to the union of the right lumbar colon with the arch; the posterior to the superior extremity of the right kidney and capsula renalis.

The *circumference* of the liver is irregular in figure and of unequal thickness; and all, except its posterior margin, covered by peritonæum. 1. The anterior edge is thin, and has two notches; one deep and narrow, the commencement of the longitudinal fissure, lodging the remains of the umbilical vein, and the duplicature of peritonæum which surrounds it; the other larger, receiving the fundus of the gall-bladder; but not always found. 2. The posterior edge is shorter, but thicker, especially to the right. It is attached to the diaphragm by the triangular and lateral ligaments, between which it is destitute of peritonæal covering, and connected by cellular membrane with the diaphragm. In its middle is an irregular depression which terminates the great fissure, and a fossa which assists in forming a canal for the vena cava inferior, at the bottom of which the hepatic veins terminate.

STRUCTURE OF THE LIVER. Of a peculiar character, consisting principally of numerous vessels; the ramifications, namely, of the vena portæ, (a venous system of peculiar structure, distribution, and function); those of the hepatic artery, of the hepatic veins, and of the excretory ducts: to all which add, the numerous branches distributed to it, of nerves and absorbent vessels.

It derives its principal covering from the peritonæum, which is continued on to this viscus from different surrounding parts. It leaves different parts uncovered; viz., the posterior edge, the two fissures, the depression for the vena cava, and that for the gall-bladder. Beneath this is condensed cellular membrane.

VENA PORTÆ. This consists of two orders of vessels, which communicate by a common trunk: the one formed of the veins which return the blood from the chylopoietic viscera, from the spleen, pancreas, stomach, and intestines, called the vena portæ abdominalis; the other, called the vena portæ hepatica, consisting of the ramifications of the trunk in the substance of the liver, to which they are distributed like arteries. The trunk of the vena portæ abdominalis is formed more immediately by the splenic and superior mesenteric veins. It passes upwards and to the right from the vertebral column to the porta, being about four or five inches in length: is at first placed behind the right extremity of the pancreas and duodenum, afterwards within Glisson's capsule. At the porta it bifurcates, the branches forming a canal lying horizontally in the porta, each making nearly a right angle with the trunk. Of these branches, the right, which is the shorter, but larger of the two, passes to the right lobe, and ramifies in its substance. The other (the lesser, but longer) is continued to the left as far as the great fissure, unites with the ligamentous remains of the umbilical vein, and is distributed to the left lobe. The ramifications of the vena portæ take a horizontal direction. The ultimate divisions of the vena portæ, it has been inferred from injections, anastomose with the radicles of the biliary ducts and hepatic veins. It is found also that minute injections pass into the hepatic arteries, and if thrown into any one order of vessels find their way into the rest. The branches of the vena portæ are accompanied by those of the hepatic arteries, veins, biliary ducts, and lymphatics, and they are all included and connected by a dense cellular structure. The vena portæ, like the rest of the abdominal veins, differs from the general venous structure by the greater thickness of its coats and the absence of valves.

Hepatic Artery. Is a branch of the cœliac, subdividing into two principal branches; these pass into either lobe at the porta, again subdivide, and are continued with the ramifications of the vena portæ.

Hepatic Veins. Take their origin from all parts of the substance of the liver by capillary extremities, which communicate with the hepatic arteries and vena portæ. They unite into larger and less numerous branches, and terminate by three or four principal trunks in the vena cava inferior behind the liver. There are also some few smaller branches.

Biliary Ducts. Arise by minute extremities, from all parts of the substance of the liver. Their ramifications accompany the nerves and vessels. In making a section of the liver their orifices may be distinguished by the yellow fluid which exudes. These have been called *pori biliarii.* They gradually unite into larger branches and form trunks, which are all brought together in the ductus hepaticus, which is found in Glisson's capsule.

SUBSTANCE OF THE LIVER. Tender, and may be broken down by pressure with the finger, without injury even to the peritonæal covering. Even abstracting the vessels above described, which with their various ramifications, constitute so large a portion of the whole mass, there appears to be a structure peculiar to the *substance* of the liver, *as* such. If a section be made of the viscus, it presents a smooth surface, composed of small points of a reddish brown and pale yellow intermixed. The orifices also of the vessels distributed through its substance become perceptible in the manner already noticed. If a portion of the liver be torn away or broken off, the surfaces will appear rough, granulated, and made up of small irregularly rounded grains or bodies, of a reddish brown colour and soft consistence. These have been called *acini*, and if we take thin sections or slices, injected minutely and dried, minute vessels are seen to radiate from them, and are thence named *penicilli*. These grains are united, as well as the vessels, by a cellular texture.

GALL-BLADDER (vesicula fellis). It is a membranous bag of a pyriform shape; situated under the right lobe in a superficial cavity, as already noticed. Superiorly, it is connected to the substance of the liver; below, it presents a surface more considerable than the former, and covered by peritonæum. This is contiguous to the pyloric extremity of the stomach, to the duodenum, and the right extremity of the arch of the colon; all of which parts are tinged, in the dead body, of a yellow colour, from the transudation of the bile. It is divided into *body*, *fundus*, and *cervix*. In the erect posture its fundus, or base, is situated anteriorly, inferiorly, and to the right; its cervix, posteriorly, superiorly, and to the left. The base is covered more or less by peritonæum; it answers to a notch in the liver, and is more or less visible according to its state of distension. The cervix is bent so as to form a convexity above and a concavity below, and terminates in the *ductus cysticus*. This is about the same length as the hepatic duct, with which it unites below, so as to form the ductus communis choledochus.

The gall-bladder is found, by dissection, to be composed of two coats:—1. An external, or *peritonæal*, which is partial, belonging only to the under surface and base, passing off from the circumference of the cavity in which the gall-bladder is placed, and covering rather more than half. Under this coat there is a quantity of dense cellular membrane, forming numerous dense filaments, which take the length of the bladder, and have by some anatomists been described as a muscular coat. 2. An internal, or *mucous*, of some thickness, and of a white colour, but after death becoming yellow from the transudation of the bile.

It has a villous appearance; and is disposed in numerous rugæ, or folds, which have a reticular distribution. It has numerous follicles for the discharge of a protecting and lubricating mucus.

DUCTUS COMMUNIS CHOLEDOCHUS. By the union of the cystic and hepatic ducts at an acute angle, the ductus communis choledochus is formed, appearing, indeed, as a continuation of the latter. It passes before the vena portæ in Glisson's capsule, gains the posterior part of the right extremity of the pancreas, passes behind the second portion of the duodenum, here sometimes joining with the duct of the pancreas, but more commonly passing with it through the muscular coat. The two ducts then accompany each other obliquely between that coat and the villous of the duodenum; and then terminate, by a common orifice, behind the second curve of the duodenum.

STRUCTURE OF THE DUCTS. The ducts of the liver and gall-bladder, and the common bile duct, are composed of two tunics; an external, which partakes of the nature of the cellular texture, but extremely dense, and composed chiefly of whitish longitudinal fibres. The second is a mucous membrane, villous, and in some degree reticulated like that of the gall-bladder. At the beginning of the ductus cysticus it forms numerous folds, or partitions, so as to render the passage tortuous. They are generally found tinged by the transudation of the bile.

The spleen and pancreas are now to be removed with the duodenum, in order to examine their structure.

OF THE SPLEEN.

The spleen is of a purple, or livid colour, mixed commonly with patches of a bright red, or black; of an oval figure, but subject to variations, and sometimes more or less triangular or square. The size varies, differing considerably in different individuals; and, though in the ordinary use of words there is but one proper spleen, it is not uncommon to find in the great omentum one, two, or more, small bodies of the same apparent structure.

It is divided into two surfaces (an external and an internal) and a circumference.

The *external surface* is convex, contiguous to the diaphragm (often indeed united to it by preternatural adhesions). It corresponds to the four last ribs on the left side. The *internal surface* is divided lengthwise into two parts, by a depression, which has been called the fissure of the spleen; in it there is commonly some fat, and at this part the vessels and nerves enter. It is slightly concave, and is contiguous to the left extremity of the stomach above, and to the kidney below. The *circumference* of the spleen is irregular, being commonly thicker above and behind than in the opposite directions. The edge is sometimes regular and smooth, but is often interrupted by notches indefinite in extent and number.

The *substance* of the spleen is remarkably soft, and yields readily to the finger. It consists principally of a congeries of blood-vessels, in addition to lymphatics, nerves, and cellular membrane; but these forming a peculiar structure. It is invested by a continuation of the peritonæum, which covers it entirely, except at the fissure; but here it passes off, being continued with that fold of the peritonæum, that fixes the spleen to the diaphragm; with that part of the same that goes to the stomach; and with the greater omentum. Between these are the splenic vessels.

The *arteries* of the spleen are branches of the splenic artery; which is itself one of three into which the cœliac divides. It takes its course along the edge of the pancreas; at the left extremity of which it divides into five or six branches that penetrate the substance of the spleen at the fissure. These branches again subdivide and ramify so numerously that the spleen appears a mere vascular congeries.

The *veins* are collected into five or six trunks, forming the splenic vein by which the blood is returned to the vena portæ. They are larger than the arteries.

The *intimate structure* has not been clearly explained. If a healthy spleen be cut through, its texture readily yields. The cut surfaces present a spongy appearance, intermixed with small granular bodies varying in size and of a greyish colour. These have been called the *acini* of the spleen. After maceration, when the cellular texture of the spleen has been in a great measure destroyed, the ramifications of the splenic artery are seen to terminate in these little bodies, which on minute injection seem to be a congeries of vessels. If the cut surface of the spleen be scraped, there exudes a quantity of livid half-coagulated blood, supposed by some to have remained in the capillary vessels of the spleen, whilst other anatomists conceive that it had been deposited in a cellular structure interposed between the arteries and veins, as in the placenta and corpus cavernosum of the penis. That the spleen consists in a great measure of a cellular texture may be seen when the blood is evacuated by repeated washing, or by inflating and partly drying it; it will be then found to be made up of a network of firm fibres, crossing each other in all directions. The connexion of this structure with the blood-vessels may be demonstrated by blowing air either through the arteries or through the veins; for in so doing the whole spleen becomes inflated. The communication is much freer with the veins, however, than with the arteries, for even a coarse injection will find its way from the veins, but no injection will pass from the arteries without rupture.

OF THE PANCREAS.

The pancreas is a conglomerate gland of a yellowish colour: long and narrow, and flattened both anteriorly and posteriorly. It is divided into two extremities; two surfaces, an anterior and a posterior; and two edges, a superior and an inferior. The *superior edge* is thicker than the *inferior;* and upon it is a depression which lodges the splenic artery. The *right extremity,* called sometimes the head of the pancreas, is larger than the left, and adheres to the second curve of the duodenum. From this extremity there generally extends along the duodenum a process called the *lesser pancreas.* The *left extremity* is connected with the spleen. In *structure* it resembles the salivary glands, being of a firm consistence, and composed of lobes, and these again of smaller lobes (or lobuli) connected by a firm cellular structure. The pancreas has no other external covering than the peritonæum, which covers it superiorly and anteriorly.

Its *excretory duct* is membranous, white, and of inconsiderable thickness. It arises by minute radicles, which unite and form a single canal about the size of a small quill, but which gradually becomes larger as it approaches the duodenum. It passes through the middle of the gland, and may be displayed by a longitudinal incision of the gland; it is situated nearer to the anterior surface, and its course is not perfectly straight. It receives in its passage collateral branches, and before its termination a canal of less size from the lesser pancreas. It then penetrates obliquely from above to below the coats of the duodenum, and usually terminates at one common orifice with the ductus communis choledochus, at the lower part of the second curve of the duodenum.

§ 3. OF THE URINARY ORGANS.

The dissection of these organs may be commenced by examining the situation of the kidneys, and of the vessels connected with them and the organs of generation.

KIDNEYS. Are of a pale red colour, and are situated deep in the lumbar region. They are placed one on each side of the spine, extending downwards from a point nearly opposite the eleventh rib, and connected with the diaphragm, and the psoas, quadratus, and transversalis muscles. They are embedded here in a considerable quantity of fat contained in a loose cellular texture, which has been sometimes called the tunica adiposa. The right kidney, lying behind the colon, is somewhat lower than the left, being placed immediately below the large lobe of the liver, which occupies more space than the spleen fills on the opposite side. The left kidney is placed below and behind the spleen, and posteriorly likewise to the left portions of the stomach, pancreas, and colon.

Through the abdomen along the spine inclined to the left side of the lumbar vertebræ the *aorta* is seen taking its course. On its right side is the *vena cava inferior;* while on each side of it, and nearly midway between the superior and inferior mesenteric arteries, arise the *spermatic arteries.* These descend over the psoæ muscles. In the male they are then continued to the spermatic cord to be distributed to the testicle: in the female pass between the layers of the ligamenta lata to be dispersed upon the ovaria and fundus of the uterus. There are also corresponding veins to the arteries called the *spermatic veins:* the right terminates in the inferior cava, but the left passes to the left emulgent vein.

The arteries of the kidneys are called *emulgent,* or *renal.* They are derived from the aorta, passing off at nearly right angles; are commonly two in number, and of considerable size; but frequently more, and of smaller size. The right is longer than the left on account of the position of the aorta, and commonly passes behind the vena cava; but they both pass outwards and a little downwards, and as they approach the kidney divide into branches, which pass in at the sinus. The *emulgent veins* are larger than the arteries, forming a large trunk on each side which lies anterior to the corresponding artery, and runs transversely to the vena cava; the left, which is the longer of the two, passing across the fore part of the aorta.

The *ureters* or excretory ducts of the kidney are about the size of a quill. At their origin they are situated behind the emulgent vein; they then descend obliquely inwards behind the peritonæum, upon the psoæ muscles, are continued into the pelvis, and terminate, as will be seen hereafter, at the under, outer, and back part of the bladder.

The kidney and *capsula renalis* may now be taken out in order to examine their structure. The kidney, like the figure of the bean so called, is elongated from above to below, its outer margin convex, and its inner concave, having a depression or *sinus* at which the vessels enter; and its upper extremity is broader and more curved above than the inferior. It is covered only anteriorly by the peritonæum, which is loosely connected with it by cellular membrane. But it has a proper covering *(tunica propria)* which closely invests the whole exterior of the gland, and passes in with the vessels at the sinus. It forms a thin layer, and appears composed of condensed cellular membrane.

The substance of the kidney is firm in its consistence. It is formed of two distinct kinds of structure—the *cortical*, and the *tubular* or medullary. The *cortical* forms the exterior of the gland, being disposed in a layer of about a quarter of an inch in thickness; besides which it sends in partitions (columnæ; septa) which divide the portions of medullary substance, diminishing in thickness as they extend towards the pelvis of the kidney. This part of the kidney is less firm and more easily torn than the medullary. It is of a yellowish or brownish red, and principally composed of vessels. It is in this part of the kidney that the branches of the emulgent artery minutely ramify, terminate on the one hand in the extremities of the veins, and on the other furnish the secretion of the urine from their own minute extremities; for which cause the cortical has been called the secerning part of the kidney.

The *tubular* or medullary substance is denser (firmer) in its consistence, and is distinguished by its reddish white colour. It is formed of several conical bodies of different size, whose base is placed towards the exterior, and apex towards the pelvis, of the kidney, surrounded except at the point by the cortical substance. These bodies have a striated appearance, being composed of the ducts *(tubuli uriniferi)* which convey the urine after its secretion in the cortical part, and pass from the base to the point, where they terminate by open mouths from which the urine may be expressed. The points of the cones just described project, and are called the *papillæ,* or *processus mammillares.* These vary somewhat in figure; and also, like the medullary cones, in number, being found from eight to eighteen; but often one cone has two mammillary processes, or two cones unite in one larger process.

The points at which the uriniferous tubes begin, and where secretion takes place, are supposed to be small corpuscles, or *acini,* which become distinct when the kidney has been minutely injected. Towards these the minute ramifications of the artery pass in a tortuous course.

The papillæ are surrounded by membranous tubes called *infundibula* (or *calices*) the points of the papillæ projecting within them. They are sometimes the same in number with the papillæ, but frequently vary in consequence of two or more opening into the same infundibulum. They are of different lengths, and commonly join into two or three larger trunks, which terminate in a membranous cavity of some size, called the *pelvis.* It is of a conical form, situated in the sinus of the kidney, appearing partly within and partly without its body, and at a little distance from the sinus it contracts and forms the *ureter.* The pelvis is occasionally double.

The structure of the ureter, pelvis, and infundibula, is similar in each, consisting, exteriorly, of a membranous covering which does not appear to differ from condensed cellular membrane, and internally of a mucous coat; but which is indistinct. A third or muscular coat has been described as belonging to the ureter, but its existence is doubtful.

CAPSULÆ RENALES (capsulæ atrabilariæ, renes succenturiati, glandulæ supra-renales). Are two small bodies situated one on each kidney, at the upper and inner part, and surmounting it like the comb of a cock. They vary in figure, are flattened, sometimes oval, more commonly like a wedge broad below, and hollowed in adaptation to the kidney, and edged above. They are larger in the fœtus than in the adult. They are usually of a dark yellow colour; covered anteriorly by peritonæum; and besides their connexion to the kidney are attached to the diaphragm, the right to the liver, the left to the spleen and pancreas.

Their surface is furrowed so as to have the appearance of a conglomerate gland; and, within, they have a cavity, between the anterior and posterior paries, which may be inflated, and contains a yellowish brown or bloody coloured fluid; but these circumstances are not always distinctly noticeable.

§ 4. OF THE DIAPHRAGM.

DIAPHRAGM (diaphragma, septum transversum). Is a broad thin muscle, which forms a partition between the cavities of the thorax and abdomen. It is broad at the sides and narrow in the middle; is concave below and convex above; and is considerably higher before than behind, so that the cavity of the chest reaches down posteriorly behind the upper part of the cavity of the abdomen. It is usually divided into a superior or greater muscle, and an inferior or less muscle.

a. SUPERIOR OR GREATER MUSCLE OF THE DIAPHRAGM.

Origin. By fleshy slips from the cartilago ensiformis and from the cartilages of the seventh and all the inferior ribs. From these attachments the fibres radiate from the circumference towards the centre.

Insertion. Into the middle or cordiform tendon. This tendon in shape somewhat resembles a trefoil leaf, and is formed by tendinous fibres running in different directions, and interwoven with each other. On the right side of the tendon is a rounded triangular *opening* for the passage of the vena cava inferior from the abdomen into the chest.

b. INFERIOR OR LESS MUSCLE OF THE DIAPHRAGM. Called also the Appendix. Is situated on the lumbar vertebræ.

Origin. By four heads from the three uppermost lumbar vertebræ, of which the fleshy bellies form the *crura* of the diaphragm. These unite, are continued upwards, and spread in their ascent. The inner and longer crura leave between them a long oval *opening* (hiatus aorticus) through which the aorta passes from the thorax into the abdomen. Above this opening the fasciculi of the crura on each side decussate in part, and again separate to form an oval *aperture* (foramen œsophageum) which is situated rather to the left, and through which the œsophagus is continued from the thorax into the abdomen.

Insertion. Fleshy into the cordiform or middle tendon.

The diaphragm is sometimes partially defective, so as to leave an opening through which some of the contents of the abdomen may be protruded, and form a hernia of the diaphragm.

CHAPTER II.

Of the Organs of Generation in the Male.

§ 1. OF THE PARTS EXTERIOR TO THE PELVIS.

SCROTUM. Contains the testicles. It is formed by a continuation of the common integuments. A line, termed *raphe,* extending from the penis longitudinally backwards over the middle of its surface, to the perineum, divides it into two equal parts. Beneath the skin a muscle has been described by some anatomists, called *Dartos.*

The inner surface of the scrotum is lined with reticular membrane which serves to connect it with the covering of the testicles. It is long and loose in its structure so as to allow of free and considerable motion. Opposite to the raphe it is condensed so as to form a *septum* between the sides of the scrotum and the testicles.

TUNICA VAGINALIS. Is a serous membrane which gives a double covering to the testicle, having the loose cellular membrane of the scrotum attached to its exterior. Originally produced by the peritonæum, it subsequently forms a shut sac, or circumscribed cavity, which is disposed with respect to the testicle as the pericardium is with respect to the heart, a disposition which it has in common with other reflected membranes; it gives the testicle a close covering, and is then reflected so as to give it a second or loose covering. In its structure it resembles the peritonæum, externally cellular, and connected with the adjacent parts; internally smooth, and unconnected, and its surface lubricated by a secretion, which preserves the mobility of the parts, and protects the testicle from pressure. On cutting open the reflected portion the position of the testicle is seen. It is placed obliquely, the upper part projecting forwards, and the part called the epididymis at the outer and back part. The left testicle is situated lower than the right. They are attached to the spermatic cords which are connected with them at the lower and back part.

Spermatic Cord. Consists of the vessels and nerves belonging to the testicle, and reaches from the parietes of the abdomen to it. It has three *coverings*:—The *exterior* is derived from the *aponeurosis of the external oblique*, continued around it within the scrotum; it is distinct, and becomes frequently of considerable thickness in consequence of long continued hernia. The *second* is that of the *cremaster* muscle. This consists of pale fibres, which derive their origin from the lower edges of the internal oblique and transverse muscles of the abdomen, surrounding the cord, and passing with it through the abdominal ring, as far as the testicle, where the fibres spread upon the tunica vaginalis and into the cellular membrane of the scrotum. The *third* covering is the *tunica vaginalis*, a continuation of the covering of the testicle, which also gives to it a double covering, but is commonly not distinct, from its cavity having been obliterated in the completion of the healthy processes, and thus confounded with the common cellular membrane. In some persons, however, it is distinct and not closed.

Vessels of the Cord. The spermatic arteries have been already spoken of.

The *veins* are larger and more numerous than the arteries. They pass upwards in the spermatic cord, forming a plexus, which has been called the *corpus pampiniforme*, or pyramidale.

The *vas deferens*, the excretory duct of the testicle, begins from the lower part of the epididymis. It is at first serpentine, becomes then straight, and passes up with the vessels of the cord and through the inguinal canal. It is of a whitish colour; its parietes are firmer and thicker than those of any other excretory duct, so as, when put between the finger and thumb, to appear like whip-cord. There is only one tunic distinct, which in some parts has nearly the consistence of cartilage. It is probably lined by a mucous membrane.

A small artery derived from the internal iliac accompanies the vas deferens; in addition to which a branch of the epigastric artery is distributed to the cremaster muscle.

OF THE TESTICLE.

The testicle is of an ovoid form, flattened at the sides; it varies somewhat in size in different individuals. It is plump and large in youth, but becomes small and flaccid in age. Not unfrequently one testicle is larger than the other. It appears of a whitish colour, owing to its exterior covering.

The situation of the *epididymis* at the outer and back part of the testicle has been already noticed. It is inclosed in the same covering of tunica vaginalis. It is of a lengthened form, adapted by its bend to the surface of the testicle; it is larger at the extremities, more especially at the upper extremity, than in the middle, where it is flattened. The upper extremity is called the globus major, or head; the lower, the globus minor or cauda. It is attached to the tunica albuginea of the testicle generally by one of its edges, and by the head and the cauda, particularly by the latter, which has a firm connexion; the tunica vaginalis dips in between, covering only those parts not attached to the testicle, and forms two little pouches between the testicle and the epididymis, which at the under part is turned backwards to form the vas deferens.

TUNICA ALBUGINEA. Is the proper covering of the testicle. It has been confounded with the tunica vaginalis, but differs entirely from that membrane in structure. With some care the tunica vaginalis may be dissected in portions from the albuginea, especially at the parts where it begins to be reflected, the connexion being less intimate there than at other parts. It is whitish in colour, so as to give that appearance to the testicle when shining through the tunica vaginalis; it is of moderate thickness, but extremely firm, so as to give support and protection to the delicate structure of the testicle. It appears composed of fine dense, white, shining, tendinous-like fibres, intimately interwoven with each other without regular arrangement. The internal surface is rough and cellular, and a number of filaments pass from it through the substance of the testicle, extending from behind to before in a radiated manner, forming *septulæ*, or partitions, between which the blood-vessels and seminiferous tubes are disposed.

SUBSTANCE OF THE TESTICLE. It is made up of the excretory ducts of the testicle, together with blood-vessels, lymphatics, and nerves. On cutting open the albuginea it appears of a yellowish colour and pulpy consistence. The testicle is made up of the *tubuli seminiferi*, minute ducts, which begin from the extremities of the secreting arteries, and are for the conveyance of the semen. The ducts are extremely numerous, are very minute, and are coiled up between the septulæ in the form of lobes, which are above twenty in number. At the upper and back part of the testicle, opposite to the attachment of the epididymis, the tubuli are collected together; they communicate and form fewer and larger trunks; constituting at this part an irregular net-work which has been called the *rete testis*, and intermixed with a good deal of cellular membrane. From the rete more than twenty ducts, called *vasa efferentia*, pass to the upper part of the epididymis; in the upper part or head of that body they become much convoluted, in the shape of cones called *coni vasculosi.* The vessels forming the coni unite in a single duct, which by its numerous turns connected by a firm cellular substance forms the rest of the epididymis. The duct increases in size as it descends, below it is reflected upwards from the extremity of the epididymis, and ascends with the turns unfolded, but still distinct, and terminates by forming the *vas deferens,* the course of which has been already described.

[illegible] OF THE PENIS.

The penis is more or less of a cylindrical figure. The part by which it is attached is called the *root;* the opposite extremity, by which it terminates, is formed by the glans; the intervening part is named the *body.* It is covered by the common integuments, continued from the scrotum and pubes. At the under part is a projecting line called *raphe,* which runs along the penis, and is continuous with that of the scrotum. At its extremity the skin forms a covering to the glans, which is called the *prepuce.* It is attached at the under part of the glans by a fold, called the *frænum,* which fixes the prepuce to the glans, near the opening of the urethra. It is in general long, so as to allow of the complete denudation of the glans. Near the corona glandis are situated numerous mucous follicles, especially near to the frænum; they are called *glandulæ odoriferæ* from the strong and peculiar odour of their secretion; it is an oily mucus for the lubrication of these parts.

The penis is composed of three portions, two of which form the upper part and sides of the body, called corpora cavernosa; the third is situated below, and is named corpus spongiosum.

The Corpora Cavernosa appear, when distended, like two equal, but irregular, cylinders, closely applied and joined to each other. At the posterior extremity they separate on each side, at the under part of the symphysis pubis, into a blind conical extremity somewhat more than an inch in length, called *crura,* by which the penis is fixed, they being attached to the inner part of the rami of the ossa ischia and ossa pubis.—They terminate anteriorly in a rounded extremity, to which the glans is attached. They have a groove above, which lodges the principal vein of the penis, and a considerable depression runs along the penis between them below, for receiving the corpus spongiosum urethræ. They are connected also to the symphysis pubis by a broad triangular production, called the *ligamentum suspensorium;* but which appears rather to be of the nature of condensed cellular membrane.

The corpora cavernosa have each an exterior elastic covering, or sheath, of ligamentous structure, which has numerous perforations for the passage of blood-vessels. The substance of the corpora cavernosa is composed of filaments and plates of cellular membrane, forming the whole into an intricate and irregular network. This is seen after the blood, of which always a considerable quantity remains, has been removed by maceration.

The corpora cavernosa are separated lengthwise by a partition (or *septum),* attached by its upper and under edges to the sheath, and appearing to have the same structure. This *septum* begins at the junction of the crura, but is not continued distinctly to the extremity of the penis. The greater part is composed of parallel and vertical cords, between which are openings, which allow of a ready transmission of fluids from one of the corpora cavernosa to the other. It has been also called the *pecten.*

The CORPUS SPONGIOSUM, (also called Corp. Spong. Urethræ, from its lodging and surrounding the urethra) is situated under and between the corpora cavernosa. It projects behind the junction of the corpora cavernosa, its posterior extremity dilating into a conical rounded projection, called the *bulb* (or bulb of the urethra). This is placed between the crura, and extends from the root of the penis to near the anus, connected to the surrounding parts by a dense cellular substance, and attached posteriorly to a ligamentous expansion. It projects most at the under and back part. The corpus spongiosum is contracted where it joins with the corpora cavernosa, then extends along beneath them, and at their extremity is a second time expanded into the body, called the *glans penis.* The glans is of a conical form, having a base or broad part and an apex or tip. The base has an oblique direction, so that the glans is about twice as long above as below. It covers and incloses the ends of the corpora cavernosa, from which it is separated by a continuation of their ligamentous covering. The base is encircled by a prominent margin, most distinct posteriorly, and called *corona glandis,* behind which is a contraction, called often *cervix.* (At this part are situated the glandulæ odoriferæ). The glans is covered by a continuation of the common integuments, which here, however, are extremely thin and delicate.

The corpus spongiosum has an exterior covering which resembles that of the corpora cavernosa, but is less dense and strong. Its internal structure also resembles in appearance that of the corpora cavernosa; but some anatomists have considered it to be a congeries of veins.

§ 2. OF THE PERINEUM.

In order to perform the dissection conveniently, it is necessary to fix the subject in the same position as that for the operation of lithotomy. Beneath the integuments is situated a considerable quantity of fat intermixed with tendinous fibres. After removing these, the muscles of the perineum, or those in the *perineal region,* will be brought into view: viz.

ERECTOR PENIS.

Origin. Tendinous from the inner side of the tuberosity of the ischium; runs upwards, fleshy, surrounding the whole of the crus of the penis.

Insertion. Tendinous into the ligamentous sheath of the corpora cavernosa, as far as their junction.

ACCELERATOR URINÆ.

Origin. Fleshy from the sphincter ani, by means of interposed cellular substance, and from the membranous part of the urethra; and tendinous from the crus and from the beginning of the corpus cavernosum. It forms a thin layer, the inferior fibres of which run more transversely than the superior.

Insertion. Into its fellow by a tendinous line which runs along the middle of the bulb; so that the two muscles together completely inclose the bulb.

Inaccurat

TRANSVERSUS PERINEI.

Origin. From the tough membranous substance on the inside of the tuberosity of the ischium; runs transversely inwards.

Insertion. By means of condensed cellular substance into the accelerator urinæ and sphincter ani.

There is sometimes a *transversus perinei alter* distinct, having the same attachments a little farther forwards, and running more obliquely.

SPHINCTER ANI.

Origin. From the extremity of the os coccygis; it runs forwards in two columns near the verge of the anus, so as to form an oval muscle, which surrounds the extremity of the rectum.

Insertion. By a narrow termination into a condensed cellular substance, which connects it with the acceleratores urinæ and transversi perinei.

LEVATOR ANI. This muscle should be laid bare, but it cannot be completely dissected till the os innominatum has been separated. In continuing the dissection, a thin *ligamentous expansion,* will be found deep-seated between the pubes and ischia, stretched between the rami of the pubes, of a triangular form, to which the bulb is firmly connected, and through the centre of which the urethra passes.

Origin. By a distinct edge from the os pubis within the pelvis, at the upper edge of the foramen thyroideum; from the aponeurosis covering the obturator internus and coccygeus muscles; and from the spinous process of the ischium. Its fibres descend and converge.

Insertion. By intervening cellular substance into the sphincter ani and acceleratores urinæ, and into the extremity of the os coccygis. The two muscles form together a kind of funnel, which surrounds the extremity of the rectum, neck of the bladder, prostate gland, and part of the vesiculæ seminales.

§ 3. OF THE SIDE VIEW OF THE CONTENTS OF THE PELVIS.

We have brought this part of the dissection under a distinct title in order to convey a more accurate knowledge of the relative position of these parts.

The side view of the contents of the pelvis may be prepared by separating the left os innominatum at the sacro-iliac symphysis, cutting through the symphysis pubis without injuring the urethra below, then turning the viscera to the right side, distending the bladder, and stuffing the rectum. The accuracy of the impression will, however, much depend upon bearing in mind the changes producible by changing the position of the pelvis. It has been already observed, that in the erect posture of the body, and likewise in the horizontal, if the lumbar vertebræ be not incurvated, the axis of the pelvis will form an acute angle with that of the trunk. But in proportion to the raising of the pelvis, or to the incurvation of the lumbar vertebræ, the angle will become less and less, till at length the axes of both will coincide.

The position of the bulb of the corpus spongiosum, with respect to the adjacent parts, will now be better seen. Situated between the diverging rami of the ossa pubis and below their symphyses. It is here fixed in its position from its connexion with the *triangular layer* of condensed cellular, or ligamentous-like substance, attached to the rami, and reaching up to the symphysis pubis. This also sends processes backwards to the prostate and to the bladder, which fix and connect these parts, as well as the membranous portion of the urethra, by the side of which they run. Immediately behind this, and behind the lower part of the symphysis pubis, is placed the *prostate gland,* which surrounds the neck of the bladder, is connected to the pubes and adjacent parts by a quantity of tough cellular substance, and lies upon the fore part of the rectum. It may be felt by passing the finger up the rectum, from an anch to an inch and a half above the verge of the anus; and it is in this way that morbid alterations in its size are ascertained. The *compressor prostatæ,* depicted by Albinus and Soemmering, is a slip of muscle which begins tendinous from the os pubis between the lower part of the symphysis, and the upper part of the foramen, passes backwards in the form of a thin, narrow, fleshy slip, around the prostate, and is lost in, or joins with, the opposite *compressor,* between the prostate and the rectum.

Mr. Wilson has described also two *muscles* at this part, which deserve especial notice. They arise by separate tendinous attachments from the inside of the symphysis pubis, they descend, fleshy; separate, to inclose the membranous part of the urethra; spread themselves on its side through its whole extent, so as to form two broad triangular muscles; then fold themselves under it, and are united at a middle tendinous line, by which these muscles are both connected at one extremity, with the acceleratores urinæ, sphincter ani, and transversi perinei. These muscles contract the membranous part of the urethra, and draw it against the symphysis.

Between the bulb and the prostate is seen the *membranous portion of the urethra.* This is scarcely an inch in length; at its passage from the bulb it is not situated immediately under the symphysis, for there intervenes a strong transverse ligament. Here it passes through the dense triangular cellular substance before described; and then curves upwards to enter the prostate. It is to be remarked, that, during its course, but especially at the commencement, it is fixed in its position. Behind the os pubis is situated the *bladder;* its upper and rounded part (called fundus) is placed somewhat anteriorly. The lower and posterior part (called base) formed into a capacious pouch, is received into the hollow of the rectum; the lower and anterior, which is also the most depending part of the bladder, and narrow and funnel-shaped, is called the *neck,* and is connected with the prostate. The bladder is connected to the rectum, pubes, and surrounding parts by firm cellular membrane. When empty, its fundus does not rise above the level of the ossa pubis; but when distended with urine, it rises up within the abdomen, and is in contact with the recti: the pouch is larger, and more projecting towards the rectum. The *rectum* is situated behind; after it has descended into the pelvis, it takes the curve of the sacrum, with which it is firmly connected; but for some way above the anus, its direction is nearly strait, and it is at this part usually dilated into a larger or smaller pouch. In the hollow of the rectum, between it and the bladder, are the *vesiculæ seminales;* pyriform bodies, the narrow anterior parts of which are connected with the prostate gland, and are closely approximated to each other: but they separate as they recede upwards, so that the broad parts are at some distance from each other, and thus include between them a portion of the bladder of a triangular figure. The *vasa deferentia* pass forwards to their inner side, after descending at the back of the bladder. The ureters are also seen descending into the pelvis, crossing behind the vesiculæ, and terminating at the under and back part of the bladder, at about an inch distance behind the prostate gland.

REFLEXION OF THE PERITONÆUM. The peritonæum, after lining the lower part of the abdominal muscles, passes from the recti on to the fundus of the bladder; it is connected to the bladder and the recti muscles by loose cellular membrane, so that when the bladder from distension rises up in the abdomen, it carries the peritonæum with it, and leaves the anterior and upper part of the bladder uncovered above the pubes. It is continued then over the fundus on to the sides and posterior surface, which it covers as far as the base of the vesiculæ seminales, and terminates in a convex line, which descends between them. It passes then on to the rectum, forming a pouch between it and the bladder, and covers the fore part, and more or less of the sides, of that gut.

§ 4. OF THE STRUCTURE OF THE CONTENTS OF THE PELVIS.

For the dissection of these parts the penis should be detached, the ureters and vasa deferentia cut through, and the bladder dissected from the parts with which it is connected: the penis and bladder are then taken out entire, and the bladder inflated.

URINARY BLADDER (vesica urinaria). Some difference will arise from alterations in its capacity, but when moderately dilated it is of an ovoid figure. The regularity of the figure is not, however, exact, being a little flattened before, more convex behind, and rather wider from side to side, than from before to behind. The inferior and posterior part is the most capacious.

It is anatomically divided into *Fundus,* placed upwards and a little forwards; *Base,* below and posteriorly; *Body,* between; *Cervix,* at the under and fore part.

It is connected to the adjacent parts by means of cellular membrane and peritonæum; firmly connected to the ossa pubis by means of a ligamentous expansion, that passes from their arch to each side of the neck of the bladder and prostate gland; attached to the parietes of the abdomen by means of the remains of the umbilical arteries, which pass upwards from the sides of the bladder to the umbilicus; and by the urachus, continued to the same part from the fundus. The urachus is of a conical form, and of a fibrous structure. These several attachments have been called the ligaments of the bladder, among which is sometimes reckoned the fold which the peritonæum forms on each side where it is reflected from the posterior surface of the bladder.

The bladder is constructed of three proper coats, which are united by interposed cellular membrane. The exterior, formed by the peritonæum, is called *peritonæal*. It is, as has been explained, partial, covering only the upper and posterior parts, and partially the sides. The second coat, termed the *muscular*, is composed of distinct fleshy fibres, which are stronger and deeper coloured than those of the intestines. The external fibres which form the strongest portion of the tunic, run for the most part lengthwise on the bladder. More internally the fibres are shorter, are not placed in planes, but intermixed with each other, and take various oblique directions, so that the bladder may be contracted in every dimension during its evacuation. The fibres behind the prostate are strong and numerous, and have been called the *sphincter vesicæ*; but there seems to be no good reason for this distinction. The third, or inner, is formed of *mucous membrane*: it is united to the muscular by cellular membrane, which has been called a nervous coat. This mucous membrane is thin, presents a smooth surface, and in the healthy condition has a whitish appearance. It is rendered unequal by the projection of the bundles of muscular fibres, so as to form folds when the bladder is empty. Its internal surface is lubricated by mucus secreted, doubtless, from follicles, but which are not distinct.

At the under part of the bladder are situated three openings; of which one is placed anteriorly, the other two posteriorly. The anterior is the beginning of the *urethra*, formed by the neck of the bladder. The two posterior are the openings of the *ureters*, which are found with some difficulty. The ureters near their termination run obliquely forwards for about an inch, between the muscular and mucous coat of the bladder; they terminate upon the inner coat by a contracted, somewhat oval, opening at about half an inch distance from each other, and at the same distance behind the beginning of the urethra. This kind of termination answers the purpose of a valve into the ureter.

Prostate Gland. Is of a rounded figure, about the size of a large chesnut, embraces the neck of the bladder and beginning of the urethra, but so that the greater part by far is situated inferiorly. It has been compared in its figure to that of a heart, as represented on playing-cards. The *base,* or broad part is placed posteriorly, the *apex,* or narrow part is placed anteriorly and inferiorly towards the bulb. The lower surface is convex and projecting, and is divided by a longitudinal middle line, marking the division of the prostate into two *lobes,* which project laterally at the lower and lateral parts of the urethra. The upper surface towards the bladder is more or less concave, but at the middle of the base, between the common seminal ducts and the bladder, is placed a third projection or lobe, particularly distinct in cases of diseased enlargement, and described by Morgagni, and more recently and more particularly Sir E. Home (Phil. Trans. 1806) as a *third lobe* of this gland. This natural structure had been confounded with disease, and likewise with a peculiar structure at the neck of the bladder, as described by Mr. C. Bell, (Medico-Chirurg. Trans. vol. ii. p. 171). From the orifices, namely, of the ureters, projections are frequently seen, one on each side, extending to the prostate, and terminating together at a slight eminence; these have been called by the French, Trigone de la Vessie; and the slight eminence distinguished by the name of Luette, or Uvula Vesicæ. Mr. Bell says, that having dissected up the inner coat of the bladder, we shall find two fleshy columns that run from the orifices of the ureters, unite, and are inserted tendinous into the third lobe of the prostate.

The prostate gland has no proper capsule, but is surrounded with dense cellular membrane. Its substance is of great density and firmness, exceeding in this respect most of the glands of the body. Its texture does not present the appearance of any other glandular structure, being apparently composed of condensed cellular substance. It has, within, numerous small straight *ducts,* running obliquely forwards, which terminate by different orifices at the sides of the caput gallinaginis, afterwards to be shewn.

Vesiculæ Seminales. Are membranous pyriform cavities. Their situation has been pointed out. Their length is about one inch and a half. They are somewhat flattened with slightly convex surfaces and rounded edges. Their posterior extremities, called their *base,* are broad, and widely separated from each other; their anterior extremities, called *cervix,* are narrow, and placed close to each other. Their surface is irregular, formed of lengthened tortuous eminences, divided by corresponding depressions. When cut through, the vesiculæ appear formed of cells. But these appearances are produced (as becomes evident when they have been unfolded by maceration) by the *convolutions* of a tube, from which project about twelve *appendices*, coiled up and united by dense cellular substance. They vary in size, and the processes differ in number in different persons.

The structure of the vesiculæ seminales consists of an *exterior coat*, which is dense and firm in texture, and although not so thick, resembling the coat of the vas deferens; this being lined by a thin and delicate *membrane*, of a whitish colour, formed into different folds, so as to give to the interior a reticulated appearance, and the surface not smooth.

From each vesicula passes a *duct*, which joins at an acute angle with the vas deferens on the same side. By the junction of the two, a common short canal is formed, which converges towards its opposite, becomes smaller in its course, passes through the prostate beneath the bladder, and terminates at the veru montanum.

COWPER'S GLANDS. Are two small bodies about the size of peas, of a more or less rounded figure, situated at the back part of the bulb of the corpus spongiosum by the sides of the membranous part of the urethra, covered on each side by the accelerator urinæ. They are of firm consistence, of a reddish colour, and are unequal on the surface, having the appearance of conglomerate glands. From each gland an *excretory duct*, of about half an inch in length, passes obliquely forwards through the parietes of the urethra, and terminates within it. These glands secrete a fluid which is discharged into the urethra, the peculiar properties and functions of which are not understood.

URETHRA. May now be cut open throughout its length. The urethra begins at the neck of the bladder, passes downwards and forwards in a curved direction, first through the prostate, behind, and then under, the symphysis pubis; passes into the corpus spongiosum in the groove formed by the corpora cavernosa; and terminates by a longitudinal orifice formed by two lips at the under and fore part of the glans, from which the fold forming the frænum is continued. The divisions of the urethra are:—that *part* which passes through the corpus spongiosum; the *membranous*; and the *prostatic* portions. Its whole length may be stated at about nine inches, seven of which will belong to the first division, and an inch to each of the two latter. Its figure is cylindrical, but the diameter not equal throughout. The urethra has three *dilatations* and three *contractions*. Its first dilatation is at its origin from the bladder: in its passage through the prostate it becomes smaller, and attains its utmost contraction in the membranous portion. In the bulb it dilates anew *(sinus Morgagni)*; then gradually contracts towards and as far as the glans. In the glans it slightly enlarges again *(fossa navicularis)*; and again contracts at the orifice.

The urethra consists principally of a *mucous membrane*, which is continuous with the membrane that lines the bladder, and with the skin at the orifice of the urethra. The mucous membrane throughout its larger portion is white; but towards the orifice of a reddish hue. There is frequently an appearance of longitudinal folds, which by some have been, without sufficient evidence, thought muscular. In addition to this, the urethra is formed in its passage by the corpus spongiosum and prostate; and at the membranous part by condensed cellular membrane and muscular fibres. In the prostate the lining membrane forms the projection, which has been before noticed, called the *veru montanum* (caput gallinaginis). This is of a reddish colour, broad behind and narrow before; and here the ducts of the vesiculæ seminales, prostate gland, and vasa deferentia terminate. On the surface of the membrane where it lines the urethra in the corpus spongiosum, are found the orifices of numerous *lacunæ*, that run obliquely from behind to before, and are variable in their size. Just below the glans are one or two of larger size (lacunæ magnæ).

CHAPTER III.

Of the Organs of Generation in the Female.

§ 1. OF THE PARTS EXTERIOR TO THE PELVIS.

THE female organs of generation are divided into those parts which are placed externally, and are seen without dissection, and into the internal parts which require dissection for their examination, comprehending the vagina, the uterus, and its appendages.

The *external parts* are bounded, anteriorly, by the projection covered with hair, which is called the *mons veneris*. Below this, and continued backwards, is the *fissura magna*, formed by the most projecting of the external parts, the *labia*, which are thick before where continued with the mons, under which they are joined by an *anterior commissure*, but thinner behind where they are united by a tranverse fold of the skin, called the *frænum*, or *posterior commissure* (furcula). The fissura terminates behind at the distance of about an inch from the anus: this short space is called the *perineum*, and there is a slight indication of a *raphe* upon it. On separating the labia, are seen—1. The *Clitoris*, a small body more or less projecting, behind the anterior commissure of the labia, below the symphysis pubis—2. The *Nymphæ*, two folds which begin at the clitoris, and separating from each other, are lost upon the internal surfaces of the labia.—3. The *Vestibulum*, a triangular, slightly excavated surface, bounded at the sides by the nymphæ, and above by the clitoris.—4. The *Meatus urinarius*, more properly the *orificium urethræ*, which is about an inch distant from the clitoris.—5. The *Orifice of the vagina*, furnished with the *hymen*, or *carunculæ myrtiformes*.—6. Between this opening and the posterior commissure, a slight transverse depression called the *fossa navicularis*.

Clitoris. It is situated between the upper parts of the labia, beyond which it seldom projects, its body rarely exceeding an inch in length, and being little more than the third part of that in thickness. It is fixed to the fore part of the symphysis pubis. It consists of a *body* formed by the junction of *two crura,* or corpora cavernosa, contained in a ligamentous sheath with a septum between them. The crura are upwards of twice the length of the body, and, together with the muscles belonging to them, are attached to the crura of the ossa ischii and ossa pubis. The corpora cavernosa have the same structure as the penis in the male, except that the spongy texture is more dense.

The clitoris has a *ligamentum suspensorium* by which it is connected with the ossa pubis. It is also provided with a *glans* which is covered by a continuation of the skin. The clitoris differs from the penis of the male in being destitute of corpus spongiosum, and having no perforation in it, corresponding to the urethra, for the passage of the urine. The glans is covered by a continuation of the skin of the labia, which at its inferior extremity forms a semilunar fold termed *præputium* clitoridis. The prepuce is furnished with follicles called *glandulæ odoriferæ* upon its inner surface, and with a small *frænum* which fixes it to the glans.

Meatus Urinarius, or urethra. Has its *orifice* placed behind and a little below the glans of the clitoris, and between the two nymphæ. It is surrounded by a spongy eminence, which projects at its posterior part, and forms a kind of lip to the orifice, called by some authors the female prostate gland. The canal itself is somewhat more than an inch in length; slightly curving in its direction behind the symphysis pubis. The orifice is surrounded by several lacunæ, or follicles, of considerable depth, secreting a viscid mucus to lubricate these parts, called often *Cowper's glands.*

Orifice of the Vagina, termed likewise os externum uteri. Is placed immediately under the orifice of the urethra. It is naturally contracted in the virgin state by the membrane called the *hymen,* or the *circulus membranosus*: a membranous process, the common form of which is that of a crescent moon, the broadest part being situated towards the perineum, the opening above, and the horns lost on the sides of the orifice. After its rupture, several small eminences are found in its place: and these are supposed to be the remains of the hymen. They are generally small, firm, rounded vascular bodies, and thence called *carunculæ myrtiformes;* in number varying from five to six.

The blood-vessels and nerves of the external parts are from the pudic branches. The absorbents pass partly to the inguinal glands, partly to those on the lumbar vertebræ or in the sides of the pelvis.

§ 2. OF THE PERINEUM.

MUSCLES OF THE ORGANS OF GENERATION.

1. SPHINCTER ANI.

Origin. From the extremity of the os coccygis. It runs forwards within the skin and fat that cover the verge of the anus, forming in its passage a broad, flat, oval muscle, which surrounds the extremity of the rectum.

Insertion. By a narrow point into the transversi perinei and the tough substance of the perineum.

2. ERECTOR CLITORIDIS.

Origin. Tendinous from the inner side of the tuberosity of the ischium. It runs upward fleshy, increasing in breadth and embracing the crus.

Insertion. Into the crus and body of the clitoris.

3. SPHINCTER VAGINÆ.

Origin. From the sphincter ani, and near the perineum from the posterior side of the vagina. It passes along the outer end of the vagina, covers the corpus cavernosum, going behind the nymphæ.

Insertion. Into the union of the crura clitoridis.

4. TRANSVERSUS PERINEI.

Origin. From the inside of the tuberosity of the os ischium, running transversely.

Insertion. Into the upper part of the sphincter ani, and into a tough white substance in the perineum.

5. LEVATOR ANI.

Origin. By a semicircular edge from the os pubis within the pelvis, at the upper edge of the foramen thyroideum; from the aponeurosis which covers the obturator internus and coccygeus; and from the spinous process of the os ischium. Its fibres descend like rays from a circumference to meet those of its fellow, and form with it a kind of funnel.

Insertion. After embracing the inferior part of the vagina and rectum, into the perineum, sphincter ani, extremity of the vagina and the rectum.

§ 3. OF THE CONTENTS OF THE PELVIS AND SIDE VIEW.

INTERNAL PARTS OF GENERATION. Are the vagina, uterus, and its appendages, consisting of the two ovaria, the two fallopian tubes, the two round and the two broad ligaments.

The uterus is placed in the middle of the pelvis, between the bladder and rectum. It is continuous with the upper termination of the vagina. The appendages are situated at the sides. Two extensive doublings of peritonæum called the *broad ligaments* fix the uterus to the lateral parts of the parietes of the pelvis; forming, together with the uterus and upper part of the vagina, a transverse partition that divides the cavity into two nearly equal parts, in the anterior of which the bladder is situated, in the posterior the rectum. These ligaments are continuous with the peritoneal covering of the uterus, and with the peritonæal lining of the pelvis, and their edge is on a level with the base of the uterus. Between them, in a cellular texture containing more or less fat, are placed on each side the ovarium, the fallopian tube and the round ligament; which have separate coverings so as to project from the broad ligament, and have been called the alæ of the broad ligament.

SIDE VIEW OF THE PELVIS. (For general directions see p. 178.)

The *contents of the pelvis from the side* ought to be prepared in order to a better view of their relative position. The axes of the pelvis and trunk do not correspond; that of the former being oblique with respect to the latter. The contents of the pelvis partake of this oblique bearing, and are influenced by the form of the pelvis. The *rectum* is straight at the lower extremity, but in the greater part of its course takes the curved direction of the sacrum. Before it lies the *vagina* taking a similar curve as it rises upwards, connected to the rectum behind, and to the bladder and urethra before, by cellular membrane. It is moderately curved, and forms an obtuse angle with the uterus, with which it is connected above.

The *bladder* is situated behind the ossa pubis, as in the male. Its broadest and most capacious part is placed inferiorly and posteriorly. It is proportionally larger than the bladder of the male, and is broader from one side to the other, corresponding to the cavity of the pelvis. The entrance of the ureter will be seen at its under and posterior part.

The *urethra* is much shorter, being only about an inch and a half in length, and straighter than in the male. It is attached to the arch of the pubes by two small fleshy slips, similar to those described in the male. It begins at the most depending part of the bladder. Its direction from the neck of the bladder is downwards and forwards, so as to make a slight curve. It terminates, as has been described, just below and behind the symphysis. Behind it corresponds to the vagina, to which it is intimately connected; while before and above it is attached to the symphysis, that is to say, to the triangular ligament. At the sides it is connected to the roots of the corpora cavernosa: and alike to all these parts by a quantity of very dense cellular membrane which surrounds the urethra, and forms part of the female prostate.

The urethra is composed of two kinds of structure: a dense spongy external one, in a great measure confounded with the cellular membrane, and an internal lining of *mucous membrane* continued from that of the vagina. It has longitudinal plaits or folds, and openings of mucous *follicles*, for the secretion of a fluid to prevent the irritating effects of the urine.

VAGINA. From its curve and oblique junction with the uterus, is longer posteriorly than anteriorly; its length is about three inches anteriorly, four and a half posteriorly. It is not cylindrical, being most capacious in its middle, and of an oval form, having its long axis from side to side.

Its structure principally consists of a *membranous substance* of some thickness. Near the orifice of the vagina, the *plexus reteformis,* or corpus cavernosum vaginæ, is placed; when cut into, it appears as if formed of cells, but is, in fact, composed of a plexus of veins.

The vagina is lined by a *mucous membrane* of a greyish colour, often interspersed with livid spots. It is chiefly remarkable for the number of folds, or *rugæ,* which its surface presents, at the upper part taking various directions, but at the lower part exhibiting a regular arrangement, and becoming more distinct. The rugæ run in a transverse direction, and are disposed in an anterior and posterior column; they join together laterally, and produce a raphe at the right and left sides. The whole extent of the vagina, particularly towards its outer extremity, is furnished with *follicles,* the orifices of which are frequently visible.

ROUND LIGAMENTS (ligamenta rotunda). Are fixed to the edge of the uterus, posteriorly and anteriorly to the fallopian tube. They pass outwards and a little upwards within the doubling of the broad ligament, so as to raise the anterior fold: then gain the internal abdominal ring, and pass downwards and inwards through the inguinal canal. Having cleared the external abdominal ring, they divide into three or four smaller bundles, which are lost in the mons veneris and labia, without attachment to the adjacent bone. The ligamenta rotunda are composed of vessels and of a bundle of longitudinal fibres, resembling those of ligament, which have been thought by some to be muscular.

REFLEXION OF THE PERITONÆUM WITHIN THE PELVIS. The uterus is anatomically divided into a body and cervix, besides which are distinguished its fundus, its corners and its sides. The peritonæum passes into the pelvis, leaving the lower end of the recti muscles to cover the fundus of the bladder. The anterior and upper portion of the bladder remains uncovered, and will be more or less exposed according to the distension of the bladder, and its consequent height above the pubes. The peritonæum afterward gives a covering to the posterior surface of the bladder; it then forms two lateral folds and a pouch in the middle, similar to those in the male between the bladder and rectum; but less marked; and is reflected on to the anterior surface of the uterus, to the neck of which and part of the body it is loosely attached, the degree of covering of those parts varying according to the fulness of the bladder, which, when distended, carries the peritonæum up with it. It then gives a covering to the fundus and posterior surface of the uterus, passes a short way upon the corresponding surface of the vagina, and forms at the sides the broad ligaments before described. Behind the vagina the peritonæum is continued on to the rectum, and forms two (often irregular) lateral folds, and a pouch between.

The uterus and its appendages may now be dissected out in order to examine their structure:—

UTERUS. Is of a triangular figure, or rather like two triangles, a larger and smaller, which touch at their apices: it has hence been compared to an hour-glass. It is flattened before and behind, but more so anteriorly. Its anatomical division has been already explained. The size of the uterus varies. In those who have borne children it is larger than in the virgin state. Internally, it has a *cavity* which resembles in figure the general form of the uterus, consisting of two parts, one large and triangular, belonging to the body, the other smaller and conical, belonging to the neck. The cavity is small in proportion to the organ, and its sides nearly touch. The under part of the cervix projects into the vagina, forming a rounded smooth *eminence*, surrounded by a circular depression about it where the vagina terminates, and is attached to the cervix. This projection is more or less considerable, and varies in form. It has an oval opening called the *os uteri*, or os tincæ. The projecting part of the cervix is smooth on its external surface, placed obliquely in a direction towards the back part of the vagina, and surrounded with mucous *follicles*, which in the impregnated uterus become very large.

The uterus is covered externally by the peritonæum. It is principally composed of a compact cellular and fleshy *substance*, plentifully supplied with blood-vessels. The appearance of muscular fibres is most distinct in the gravid uterus, especially about the orifices of the fallopian tubes. At that part an arrangement of *concentric* fibres is apparent, which has been called the *musculus orbicularis Ruyschii*. It is remarkably vascular. The arteries, which are situated under the peritonæal coat, have an extremely tortuous course. The veins, which are situated within the substance of the uterus, have been called the uterine sinuses.

The uterus is lined by a fine smooth and vascular *membrane* of the mucous kind, naturally of a whitish colour, which has a porous appearance, more striking when seen through a lens.

The cavity of the cervix has two small longitudinal *lines* projecting into it, one in the anterior, the other in the posterior part; on each side of which are numerous *rugæ* running in a transverse direction. Between the rugæ are small *follicles* of the mucous kind.

FALLOPIAN TUBES (uterine tubes). Are two canals about four or five inches in length which are attached by one extremity to the corners of the uterus, and terminating in it, each by a small opening which scarcely admits the entrance of a bristle. Towards the uterus they are narrow, but become gradually larger in their passage toward the sides of the pelvis. Near their outer extremities they are unconnected, convoluted, and considerably dilated, and terminate by open and expanded mouths sufficiently large to admit the point of a goose-quill. About the orifices are the irregular pointed projections called *fimbriæ*, which are considerably longer on one side than on the other, (sometimes called morsus diaboli). The canal of the tube is very minute at its origin within the uterus, but afterwards dilates.

The *substance* of the fallopian tubes has been supposed to be muscular. It is lined by a very delicate *membrane*, probably of the mucous kind, but which it is extremely difficult to separate. It is chiefly remarkable for being furnished with many small longitudinal *plicæ*, which are most conspicuous towards the outer extremities.

OVARIES (ovaria). Are situated at the sides of the fundus uteri, about an inch distant from it, and are contained in the posterior pinions of the ligamenta lata, which give them a complete covering except at the one edge, by which they are more or less closely fixed to the ligament. They are of an oval figure, flattened on their anterior and posterior surfaces; and the size of each, when in a state of maturity, is less than the male testicle. Their surface is irregular, and is, as it were, furrowed. They are attached to the uterus by a small fibrous cord about an inch and a half in length, placed behind and a little above the round ligament called the *ligament of the ovary.* The ovaria are internally composed of a loose whitish *cellular substance* contained within a white dense tendinous-like *membrane,* resembling somewhat the tunica albuginea. Within the cellular texture are vessels and nerves, and from fifteen to twenty *vesicles,* of which the largest are seldom equal to the size of a small garden pea. They are called the vesicles of *De Graaf;* are formed of a delicate membrane, which contains an albuminous fluid; and are supposed to include the rudiments of the fœtus.

THE DISSECTOR'S MANUAL.

Section the Third,

CONTAINING THE

DISSECTION OF THE VESSELS AND NERVES.

SECTION THE THIRD,

CONTAINING THE DISSECTION OF THE

VESSELS AND NERVES.

CHAPTER I.

Preparatory Notices.

THE vessels and nerves may be examined for the most part at one time; and as the student has already gone through the dissection of the other parts according to the preceding sections, he will be prepared to understand without difficulty their course and distribution, and will be enabled to recall and re-impress the knowledge of those parts which have been already described. During this dissection then his attention must be directed to the distribution of the arteries, veins and nerves. The absorbent vessels cannot be well examined without a particular mode of preparation, and must therefore be deferred; but the glands will present themselves in the course of the dissection, and should be attended to. The dissection will proceed in the following order:

1. The EXTREMITIES, singly, with the arteries injected, for the dissection of the arteries, veins, nerves, and absorbent glands.

2. The HEAD, NECK and THORAX, with the arteries injected for the dissection of the arteries, veins, and absorbent glands. It would be inconvenient, if not impracticable, to dissect the nerves of the head and neck at the same time:

therefore, for their particular examination, they may be dissected separately. The principal nerves may, however, be displayed.

3. The Abdomen and Pelvis, with the arteries injected, for the dissection of the arteries, veins, nerves, and absorbent glands. In this dissection the branches of the sympathetic distributed to the viscera should be first traced, beginning at the semilunar ganglion and solar plexus.

In the dissection of all these parts the arteries should be followed from trunk to branch, and the veins and nerves, with the above exceptions, should be traced with them.

4. Head and Neck, for the dissection of the nerves. It is supposed that the course of the nerves within the cranium has been already examined, and consequently the course of the olfactory and optic ascertained. The order of the dissection of the rest will be—1. That of the nerves on the side of the face, viz. the branches of the facial nerve and those of the fifth pair. 2. That of the nerves of the neck, beginning with the superficial branches of the cervical, and then proceeding to the deeper-seated, viz. the lingual and its descending branch, the accessory nerve, the lingual branch of the third division of the fifth pair, the pneumogastric and sympathetic nerves and their branches, and the cervical nerves. All these nerves should be traced from above downwards. The lower jaw should then be divided to the outer side of the symphysis, and turned completely outwards, in order to see the trunk of the third division of the fifth pair and its dental branch, and those parts of the pneumogastric and sympathetic which could not be conveniently traced before. The upper part of the orbit may next be removed in order to trace the nerves distributed to the eye and its appendages. And lastly, the malar and superior maxillary bones may be removed in order to follow the branches of the second division of the fifth pair, and the sympathetic within the carotid canal.

In the description of the vessels and nerves, which follows, the order of dissection is not laid down, as it would have been inconvenient for reference, and inadequate to a comprehensive view of their distribution; but by attending to the above directions they may be traced without difficulty.

CHAPTER II.

Of the Arteries.

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§ 1. AORTA.

THE primitive trunks of the arteries, or those which arise from the heart, are the pulmonary artery and the aorta. The course and distribution of the pulmonary artery has been already given (p. 120). We proceed, therefore, to the description of the aorta.

AORTA. Is the origin or common trunk of all the ramifications of the arterial system. It arises from the upper part of the left ventricle, from which it is distinguished at its commencement by difference of structure. It first ascends, then bends backwards and over to the left side, opposite to the third or fourth dorsal vertebra; after which it descends within the posterior mediastinum, inclined to the left side of the dorsal vertebræ; it passes between the crura of the diaphragm, and continuing its course along the lumbar vertebræ, terminates at the fourth or fifth vertebra. The different portions of the aorta thus described as taking different directions, are distinguished by the corresponding names of—1. the ascending aorta, 2. the curvature or arch of the aorta, and 3. the descending aorta. The descending aorta is divided into the thoracic and abdominal aorta.

1. ASCENDING AORTA. Is inclosed during the greater part of its course by the pericardium. *To its left* is situated the pulmonary artery, which covers it anteriorly at its beginning: to *its right*, the vena cava superior; *behind it*, the right branch of the pulmonary artery: and *before it*, the sternum, from which it is separated by the anterior mediastinum.

2. ARCH OF THE AORTA. Is situated immediately before the under end of the trachea. The curve of the vessel being continued over the left bronchus, descends immediately behind it and the left pulmonary artery. Sometimes, though rarely, the aorta bends back over the right bronchus, accompanied by varieties in the origin of the arteries from the arch. It sometimes divides into two trunks, one of which forms the descending

aorta, and the other furnishes the branches to the head and upper extremities.

3. Thoracic Aorta. The aorta whilst descending in the thorax is placed in the posterior mediastinum. It has, *to the left*, the left pleura: *to the right*, the œsophagus, vena azygos, and thoracic duct: *anteriorly*, first the left bronchus and then the pericardium: *behind*, the dorsal vertebræ.

4. Abdominal Aorta. The aorta in the abdomen, where passing on the bodies of the lumbar vertebræ, is situated more nearly on the median plane than the thoracic aorta on the bodies of the dorsal vertebræ. To the *right side* of the abdominal aorta is placed the vena cava inferior. It rests *behind* upon the vertebral column, is covered *anteriorly* and *to the left* by the peritonæum; and it terminates opposite the fourth or fifth vertebra by dividing into the common iliac arteries. The division is sometimes higher.

The arteries taking their origin from the aorta may be distinguished into those arising from the

1. Ascending aorta.
2. Arch of the aorta.
3. Thoracic aorta.
4. Abdominal aorta.
5. Termination of the aorta.

1. Branches from the Ascending Aorta. Are the cardiac arteries which are described with the structure of the heart (p. 125).

§ 2. BRANCHES FROM THE ARCH OF THE AORTA.

Are those which supply the head and neck, the upper extremities, and in part the chest. They are three in number, the unnamed trunk (arteria innominata) from which the right common carotid and right subclavian arteries arise, the left common carotid and the left subclavian artery. The arteria innominata arises foremost and most to the right, the left carotid in the middle and somewhat farther back close to the unnamed trunk, and the left subclavian at a short distance from it the most posteriorly and to the left.

The arteries do not always arise in this regular manner from the arch of the aorta. They vary occasionally both in situation and in number, the excess in the latter being the more common variety, as where the right carotid and right subclavian arise separately; or where in addition to the usual vessels, the vertebral, the inferior thyroideal, or more rarely the internal mammary arise from the arch; or where different combinations of these varieties are found. Thus sometimes four, occasionally five, and more rarely six vessels, are found to take their origin from the aorta. Occasionally, however, the number is less when two or all three arteries arise from a common trunk. Sometimes, the number remaining the same, the two common carotids arise from a single trunk, and the right subclavian originates separately from the aorta. The deviation from the usual *situation*, is when the arteries at their commencement are unusually close together, or separated from each other; or when the right subclavian arises between the carotids, or between the left carotid and the left subclavian. In the latter case it generally passes over to the right side between the œsophagus and trachea.

I. UN-NAMED TRUNK (arteria innominata). It takes its course obliquely upwards and to the right, and generally divides after a passage of about an inch, but occasionally somewhat more, into the right common carotid, and right subclavian, arteries. It is covered anteriorly by the sternum and sterno-thyroidei muscles, and is crossed by the left subclavian vein. Posterior to it is the trachea. The right carotid and subclavian vessels are shorter than the left by the length of the un-named trunk.

II. COMMON CAROTID ARTERY. The common carotid (carotis communis) ascends in the neck, by the side of the air-tube, diverging in its course from the opposite artery of the same name. It reaches as high usually as the upper part of the larynx, where it terminates by dividing into the external and internal carotids. Its situation above is superficial. *Anteriorly* and *below* it is covered more or less by the sterno-cleido-mastoideus, the sterno-hyoideus, sterno-thyroideus, and omo-hyoideus muscles; *anteriorly* and *above*, it is separated from the skin, aponeurosis and platysma myoides, by the projection of the parts about the larynx, and the sterno-mastoid muscle, to the edge of which it corresponds at this part, where it rises about an inch above the omo-hyoideus. *Posteriorly*, it has the vertebral column, the rectus capitis anticus major and longus colli muscles, and the inferior thyroideal artery, a branch of the subclavian. *To the inner side*, it corresponds to the larynx and trachea, the thyroid gland, which is sometimes continued partly over it, and to the œsophagus which is placed somewhat nearer to the left than the right trunk. *To the outer side*, the internal jugular vein, and the nervus vagus situated between it and the carotid, take their course: the nerve, the vein, and the artery, are inclosed within a sheath of condensed cellular membrane. The sympathetic nerve is also situated on the outer side of the artery, but exterior to the sheath.

Sometimes one of the carotids crosses the lower part of the trachea. The right, when the unnamed trunk arises much to the left; the left when it arises from the unnamed trunk. This variety requires caution in the operation of tracheotomy. The division of the common carotid into external and internal sometimes takes place higher than usual, and occasionally after the first branches of the external have been given off. A case has been observed in which the external carotid was a short stump from which all the branches of the external came off at one point. The bifurcation sometimes takes place lower than the part above described as the usual place. The place of division, with respect to the larynx, is the same in all ages, but is situated at a greater distance from the angle of the jaw in infancy before the teeth have been cut, than at an after period, especially when the back part of the jaw is completely developed. In consequence of this, the branches of the external carotid are more exposed in the earlier periods of life.

The external and internal carotid arteries pass at first nearly perpendicularly upwards and parallel to each other. The external is situated nearer the larynx, and more anteriorly; the internal taking its course upon the muscles on the bodies of the vertebræ. Their size in the adult is nearly the same; but in infancy, owing to the larger proportional size of the brain, the internal is the more considerable vessel of the two.

a. EXTERNAL CAROTID (A. carotis externa). The external carotid is continued as high as the neck of the lower jaw, where it terminates, by dividing into the temporal and internal maxillary arteries. It passes up first behind the posterior belly of the digastricus muscle and stylo-hyoideus to near the angle of the jaw; then continues its course between the sterno-mastoideus, mastoid process, and the ear, and the ascending plate of the lower jaw, covered by the parotid gland, to the place of its division.

The branches from the external carotid may be divided into the anterior, posterior, internal, and those by which it terminates.

The *anterior branches* are the superior thyroideal, 2. the lingual, and, 3. the facial.

1. SUPERIOR THYROIDEAL (A. thyroidea superior). Usually takes its origin from the root of the external carotid; but occasionally from the common carotid. Sometimes it arises from a trunk common to it and the lingual branch. It varies in size. It winds downwards, inwards, and forwards, covered by the omo-

and sterno-~~thyroideus~~ hyoideus muscles, to the upper part of the thyroid gland. It sends off:

α. *Branches* to the sterno-mastoideus and omo-hyoideus muscles and to the superficial parts.

β. *Laryngeal branch* (R. laryngeus).—This passes forwards and inwards, and after distributing branches to the muscles below the os hyoides, is continued usually between the os hyoides and thyroid cartilage, to be distributed to the muscles and lining membrane of the larynx.

γ. *Thyroid branch* (R. thyroideus). Is the continuation of the trunk. It generally divides into two branches, of which one is continued along the upper part of the thyroid gland, and anastomoses with a corresponding branch from the opposite superior thyroideal; the second passes along the outer and posterior part of the gland, and anastomoses with branches of the inferior thyroideal. Both send considerable branches to the substance of the gland.

2. LINGUAL (A. lingualis). Is somewhat larger than the superior thyroideal. It arises commonly just above the thyroideal, and sometimes from the same trunk as the facial. It takes its course upwards and forwards over the cornu of the os hyoides, becomes covered by the hyo-glossus muscle, and is continued forwards under the tongue. It gives off:

α. *Branches* which are distributed to the adjacent muscles and pharynx.

β. *Hyoideal branch* (R. hyoideus). Distributed to the muscles above the os hyoides.

γ. *Dorsal branches* (R. dorsales linguæ). Distributed to the dorsum of the tongue, and to the parts about the passage of the fauces and pharynx.

δ. *Sublingual branch* (R. sublingualis). Supplying the sublingual gland and adjacent muscles.

ε. *Ranine branch* (A. ranina). Is the continuation of the trunk. It passes forwards at the under and lateral part of the tongue, close to the frænum, and terminates near its point, furnishing in its course numerous branches.

3. FACIAL (A. facialis, angularis, maxillaris externa). Is generally the largest of the three anterior branches, and arises a little above the last. It varies, however, in size and origin. It passes upwards and forwards under the jaw behind the digastricus and stylo-hyoideus, and is then deeply embedded in the submaxillary gland. It is next continued upwards over the side of the jaw, and is situated superficially at the under and fore part

of the masseter. It then passes towards the corner of the mouth, and, after making several turns, it proceeds by the side of the nose towards the inner angle of the eye. It sends off:

α. *Inferior palatine branch* (A. palatina inferior). Distributed to the pharynx, velum palati, the tonsil, and parts adjacent.

β. *Glandular branches* (R. glandulares). Distributed to the submaxillary gland.

γ. *Submental branch* (R. submentalis). It is given off near the edge of the jaw, along which it is continued between the attachment of the mylo-hyoideus and digastricus muscles. It furnishes branches to both muscles, and is then continued upwards over the jaw to supply the muscles and skin of the lower lip, and anastomose with branches of the coronary and dental arteries.

δ. *Small branches.* Distributed to the masseter, and to the muscles and skin of the cheek and lips.

ε. *Inferior coronary artery of the lip* (A. coronaria labii inferioris). It passes along the under lip, covered by the membrane of the mouth; and, after furnishing branches to the adjacent parts, anastomoses with the opposite branch of the same name. This branch frequently varies both in origin and size. It sometimes arises higher, and is a branch of the superior coronary. Sometimes it is very small, and is wanting altogether on one side, in which case the opposite one is proportionably larger.

ζ. *Superior coronary artery of the lip* (A. coronaria labii superioris). Is larger than the former. It passes along the edge of the upper lip, furnishes branches to the adjacent parts, and inosculates with the opposite artery. The course of the coronary vessels is extremely tortuous. From the superior coronary there are branches (R. nasales septi) sent upwards to the point and partition of the nose.

η. *Branches.* Distributed to the nose, cheek, parts about the inner corner of the eye, and middle of the forehead: and by these branches the facial artery terminates.

The *internal branch* is the ascending pharyngeal.

4. ASCENDING PHARYNGEAL (A. pharyngea adscendens, inferior). Is the smallest branch of the carotid. It arises from the beginning of the external carotid, sometimes at the part where the common carotid divides, occasionally from the root of the internal, and not unfrequently from the occipital. It ascends in the same direction as the external carotid, between that vessel and the pharynx. It then divides into branches distributed to the constrictores pharyngis, sending off likewise a branch

which passes through the lacerated opening of the base of the skull, and is dispersed upon the dura mater.

The *posterior branches* are the occipital and the posterior aural.

5. OCCIPITAL (A. occipitalis). Is a vessel of some size, and nearly as large as the anterior vessels. It arises from the back part of the external carotid nearly opposite to the lingual or facial. It is rarely a branch of the internal carotid. It takes its course over the internal jugular vein, and then between the transverse process of the first vertebra and the mastoid process of the temporal bone. It is continued under the sterno-mastoid muscle, the trachelo-mastoideus, splenius, and complexus. It then becomes superficial, runs upwards upon the occipital bone, and divides into several branches. It gives off

α. *Branches* to the digastricus, sterno-mastoideus, and glands of the neck, and sometimes a branch through the foramen lacerum to the dura mater.

β. *Descending branch*, of considerable size, which passes down between the complexus and trachelo-mastoideus, and is distributed to the muscles at the back of the neck. It anastomoses with the vertebral.

γ. *Branch* which passes through the foramen mastoideum to the dura mater. This branch is not always found.

δ. *Branches.* These, by which the occipital artery terminates, are distributed to the occipito-frontalis and integuments, and anastomose with branches of the temporo-occipital and of the opposite occipital, so as to form a network of vessels.

6. POSTERIOR AURAL (A. auricularis posterior). Is smaller and arises higher than the former. It is often a branch of the occipital. It passes upwards behind the external carotid towards the mastoid process, is continued upon the back of the concha, and terminates upon the side of the head. It gives off:

α. *Branches* to the parotid gland, the posterior belly of the digastricus, the stylo-hyoideus, and sterno-mastoideus.

β. *Stylo-mastoid branch* (A. stylo-mastoidea), which passes through the stylo-mastoid foramen, and is distributed to the meatus externus, membrana tympani, tympanum, and part of the labyrinth of the ear.

γ. *Branches.* Distributed to the ear and side of the head.

The *branches* by which the external carotid *terminates* are the temporal and internal maxillary.

7. TEMPORAL (A. temporalis). Is the smaller and more superficial. It is continued upwards in the same direction as the external carotid before the ear, through the upper part of the parotid gland, and over the root of the zygoma. It passes to a short distance upwards, immediately under the skin, along the margin of the hair, and divides into two considerable branches, an anterior and posterior. It sometimes divides close to the zygoma. It gives off:

α. *Branches* to the parotid gland.

β. *Branches* (R. masseterici) which are distributed to the masseter muscle.

γ. *Transverse of the face* (A. transversalis faciei). It arises near the division of the external carotid. It is sometimes, though rarely, a branch of the external carotid. It takes its course transversely over the masseter muscle, and accompanies the duct of the parotid gland. It distributes branches to the parotid gland and cheek, and communicates with the facial and infra-orbitar arteries.

δ. *Deep temporal.* It comes off near the zygoma, penetrates the aponeurosis of the temporalis, and ramifies within the muscle, forming communications with the deep temporal branches of the internal maxillary.

ε. *Anterior auricular branches.* Come off near the former, and are distributed upon the external ear and meatus.

ζ. *Anterior*, or *temporo-frontal branch.* It passes obliquely forwards, and divides into numerous branches; some of which are continued along the upper part of the forehead, are distributed to the skin, occipito-frontalis and orbicularis palpebrarum, and anastomose with branches of the supra-orbitar and facial. The rest pass upwards towards the vertex, and anastomose with the opposite artery and the temporo-occipital.

η. *Posterior*, or *temporo-occipital branch.* Passes obliquely upwards and backwards on the parietal bone. It distributes numerous branches to the side and upper part of the head, forming numerous anastomoses with the anterior branch of the opposite temporal, and with the occipital artery.

Many small vessels from the arteries on the head penetrate the substance of the bones.

8. INTERNAL MAXILLARY (A. maxillaris interna). Is larger than the temporal. It passes off from the external carotid where the latter is covered by the parotid gland. It takes its course first inwards and forwards behind the neck of the lower jaw, then inwards between the pterygoid muscles; it ascends forming several turns, penetrates the pterygoideus exter-

nus, passes behind the tuberosity of the superior maxilla in a horizontal direction, and terminates behind the orbit by dividing. It gives off:

α. *Branches* of small size to the ear.

β. *Spheno-spinal,* or *middle artery of dura mater* (A. dura matris media vel magna, spheno-spinalis). It passes directly upwards. It distributes branches to the adjacent muscles, to the pharynx, and other parts near it. It is then continued through the foramen spinosum of the sphenoid bone, giving off some twigs to the bones and tympanum of the ear, and having entered the cranium, branches to the lower part of the dura mater. It next divides into two branches; the anterior, which is the more considerable, passes upwards and forwards to the anterior and inferior angle of the parietal bone, where it is lodged in the groove or canal at that part, and then divides into numerous branches which spread on the surface of the dura mater. The posterior ascends on the parietal bone and squamous portion of the temporal bone, and divides also into branches. The ramifications of these vessels are lodged in grooves in the bones.

γ. *Inferior maxillary branch* (A. maxillaris, alveolaris, dentalis inferior). It passes downwards, between the pterygoidei, to which it furnishes branches, to the posterior maxillary foramen. After having passed through this opening, it is continued through the canal of the inferior maxilla, distributing branches to the teeth and substance of the bones; then passes out through the mental foramen, and terminates in branches which anastomose with branches of the facial, and supply in part the chin and under lip.

δ. *Temporal branches.* (R. temporales profundi). Are distributed to the temporal muscle.

ε. *Masseterine* (R. massetericus). Is a *branch* distributed to the masseter.

ζ. *Buccal* (R. buccalis). Is a *branch* distributed to the buccinator, and to the soft parts of the cheek.

η. *Pterygoideal branches* (R. pterygoidei). Are distributed to the pterygoidei muscles.

ϑ. *Alveolar branch* (A. alveolaris, maxillaris, superior). It arises behind the antrum, and takes its course around the superior maxilla, distributing branches to the teeth of the upper jaw, the substance of the bone, gums, and surrounding soft parts.

ι. *Infra-orbitar branch* (A. infra-orbitalis). Arises behind the orbit, passes through the infra-orbitar canal, and distributes branches in its course to the orbit, antrum, substance of the jaw, and the fore teeth. It comes out at the infra-orbitar foramen, and terminates by branches to the cheek, some of which communicate with branches of the facial artery.

ϰ. *Descending palatine branch* (A. palatina descendens, palato-maxillaris). It gives off usually a branch to the upper part of the pharynx, called *superior pharyngeal.* It then descends in the palatine canal, and passing out through the posterior palatine foramen, advances between the bone and membrane of the roof of the mouth, distributing branches to both. Anteriorly it communicates with the opposite artery, and sends a branch upwards through the anterior palatine foramen to the nose, to anastomose with branches of the lateral nasal.

λ. *Lateral nasal branch* (A. nasalis lateralis, posterior, spheno-palatina). It takes its course through the spheno-palatine foramen, and divides commonly into two branches: one ramifying to the posterior ethmoid cells, and dividing into numerous branches to the septum of the nose; the other descending on the outer side of the nose, and supplying branches to the membrane covering the turbinated bones, and to the antrum maxillare.

b. INTERNAL CAROTID (A. carotis interna).

Ascends deep seated, and most commonly slightly curving in its course, upon the rectus capitis anticus major to the base of the cranium. It then turns forwards and upwards, and enters the carotid canal, and next adapts itself by several turns to the tortuous course of that canal, nearly filling it, but surrounded by a quantity of dense cellular membrane. On entering the cranium it passes upwards and forwards, by the side of the sella turcica, and is contained in the same fold of the dura mater as the cavernous sinus, but is protected from the blood which the sinus contains by the lining membrane of the sinus. Under the anterior clinoid process it bends upwards and then backwards, and divides into branches. Thus this vessel is very tortuous in its course, and changing its direction at least five or six times.

Exterior to the cavity of the cranium it seldom gives off any branches. Occasionally, however, it furnishes a branch to the pharynx, or to the fauces, and more rarely it gives off the occipital.

At the side of the sella turcica it commonly distributes small branches to the dura mater, ear, cavernous sinus, pituitary gland, and adjacent nerves.

Where it passes up under the anterior clinoid process, it detaches the ophthalmic artery.

1. OPHTHALMIC, or OCULAR ARTERY (A. ophthalmica). Is a branch of considerable size, which is distributed by numerous branches to the globe of the eye, its appendages,

and adjacent parts. It passes with the optic nerve through the optic foramen, and generally below that nerve, and to its outer side; then takes its course between the levator oculi and nerve, on the inner part of the orbit. Its branches, which are subject to considerable varieties in origin, size, and number, are the:

α. *Lachrymal,* which passes along the outer side of the orbit, and is distributed to the lachrymal gland, and parts adjacent.

β. *Central of the retina* (A. centralis retinæ), which passes into, and through the centre of the optic nerve, spreads upon the interior surface of the retina, and sends some branches through the vitreous humour.

γ. *Ciliary* (A. ciliares). Several in number, which pass by the sides of the optic nerve, and penetrate the sclerotic coat. They divide into branches, which are distinguished as the short (A. cil. breves vel posteriores) distributed principally to the choroid coat; and as the long (A. cil. longæ vel anteriores) distributed to the iris, and forming the zona major and minor.

δ. *Muscular branches* (R. musculares). Supply the muscles, periosteum of orbit, eye-lids, &c.

ε. *Ethmoidal* (A. ethmoides). Consisting of an anterior and posterior branch, which pass through the foramina orbitaria interna, anterius and posterius, and divide into branches to the membrane lining the nose, and sinuses connected with it.

ξ. *Supra-orbitar* branch (R. supra orbitalis vel frontalis) which passes along the upper part of the orbit, is continued through the foramen supra orbitarium, and is distributed upon the muscles and skin of the forehead.

η. *Internal angular,* or *nasal* branch (R. nasalis), which takes its course to the inner angle of the eye, is distributed to the adjacent parts of the nose, eye-lids and forehead, and anastomoses with branches of the facial artery.

ARTERIES OF THE CEREBRUM.

After giving off the ophthalmic, the internal carotid furnishes the branches which supply the fore part of the cerebrum. It distributes a few branches to the infundibulum, pituitary gland, optic nerve, and third ventricle: then sends a branch backward, which from forming a communication with the basilary artery is called *the communicating,* and afterwards terminates by dividing into the anterior and middle arteries of the cerebrum.

2. COMMUNICATING (A. communicans). The size of this branch varies, but is generally considerable. It takes

its course backwards, and terminates, in a branch of the basilary, namely, in the posterior artery of the cerebrum, so as to assist in forming the circle of Willis. It distributes some branches to the base of the cerebrum.

3. ANTERIOR (A. anterior cerebri, A. corporis callosi). Passing forwards and inwards, it approaches the opposite artery of the same name, and after sending some small branches to the anterior lobe and to the olfactory and optic nerves, is joined to that artery, before the union of the optic nerves, by means of a short but large TRANSVERSE branch (A. communicans anterior transversa). From the transverse branch branches are sent off to the third ventricle, septum lucidum, and fornix. The anterior artery is then continued upwards, and bends backwards over the corpus callosum upon the internal and flat surface of the hemisphere. It divides into branches, some of which are of small size, and distributed to the corpus callosum, whilst the larger and more numerous pass between the convolutions, others spread on the surface of the hemisphere, but are all directed towards the upper part. They ramify, divide minutely, and freely anastomose in the pia mater, covering the fore and inner part of the hemisphere, and send only minute, but numerous branches into the substance of the brain.

4. MIDDLE (A. media cerebri, fossæ Sylvii). Is always considerably larger than the anterior. It passes outwards, and a little forwards, and then takes its course through the fossa Sylvii upwards. It sends some twigs into the descending cornu of the lateral ventricle, and then divides into three or four considerable branches, which pass up on the anterior and middle lobes to the upper surface of the hemisphere, spreading into numerous branches upon the pia mater, which send twigs into the brain, and freely communicate with branches of the anterior and posterior arteries of the cerebrum.

5. BRANCH TO THE CHOROID PLEXUS OF THE LATERAL VENTRICLE. Passes over the crus cerebri to the anterior opening of the lateral ventricle, and distributes branches to the thalamus nervi optici. Not always met with.

The origin of the cerebral arteries is not always constant and symmetrical, as above described; occasionally both the middle arteries arise from the right carotid, and the anterior only from the left.

III. SUBCLAVIAN ARTERY (A. subclavia).

The difference of the origin of the subclavian artery on the right and left side has been already remarked: the left arising immediately from the arch of the aorta, and the right from the unnamed trunk. The varieties occasionally met with in their origin have been also noticed. They both pass upwards through the upper opening of the chest, bend outwards over the first rib, are continued between the scaleni muscles, outwards and downwards; and having descended below the clavicle, change their name to that of the axillary arteries.

In consequence of the difference of origin of these arteries on the right and left side, they differ before they pass over the first ribs, in—α. *Situation,* the right being more superficial; the left deeply hid [arising farther back from the arch of the aorta].—β. *Length,* the right being shorter by the length of the arteria innominata.—γ. *Direction,* the right passing obliquely upwards and outwards to the space between the scaleni, whilst the left passes first vertically upwards, then suddenly bends outwards between the scaleni.—δ. *Relative position,* the right being placed more anteriorly, near to the apex of the right lung on the outer side, and separated, behind, from the vertebral column and longus colli, to which it corresponds; the left being covered from its origin by the corresponding lung, and closely applied to the longus colli.

The course of the subclavian arteries, after their arrival at the space between the scaleni, becomes the same. *Anteriorly,* they have the scalenus anticus, interposed between them and their correspondent veins, and then the subclavian vein and the clavicle, which latter they pass at an acute angle. *On the inner side,* they have the first rib, to which they are closely applied, thus affording the means of ready compression: and upon the first rib, and before they have passed it, they have the pleura immediately adjacent to them, at the part where the pleura reaches above the upper opening of the chest, and terminates in a blind extremity. *Behind,* and *to the outer side* are situated the nerves which form the axillary plexus.

The branches from the subclavian are divided—into the *Superior,* which consist of the—1. Vertebral—2. Inferior thyroideal—3. Ascending cervical—4. Supra-scapular—5. Superficial cervical—6. Deep cervical: and—into the *Inferior,* which consist of the—7. Internal mammary, and—8. Superior intercostal. These branches are commonly given off just before the artery passes between the scaleni muscles: but they differ considerably—1. in size, as they do not always furnish the same branches:—2. in number, in consequence of two or more coming off from a single trunk, and—3. in the point of origin, arising more inwards or outwards from the trunk. Sometimes small branches are supplied before these are given off to the pericardium, trachea, bronchia, and œsophagus.

1. Vertebral (A. vertebralis). Is commonly the first and largest branch. It arises sometimes from the arch of the aorta; this variety rarely takes place, except on the left side, and then seldom elsewhere but between the left carotid and subclavian arteries. It then passes upwards and through the opening in the transverse process of the sixth cervical vertebra, rarely through that of the seventh, but oftener through that of the fifth, fourth, or third. It is sometimes larger on one side than on the other. It is then continued through the openings of the transverse processes of the vertebræ above, nearly in a straight direction, as far as the second vertebra, but then becomes tortuous in its course: it forms one bend between the first and second vertebra, and after passing through the transverse process of the atlas, it changes its direction, becomes horizontal, and bends round the root of the articular process in the groove for receiving it; it passes under the occipital bone to the foramen magnum, upwards through the latter, and through the dura mater, and is then continued at first on the side of, and then below, the medulla oblongata, upon the cuneiform process of the os occipitis upwards and inwards. The two arteries thus approaching each other, after the course of about an inch within the cranium, unite at an acute angle near the posterior edge of the pons Varolii, or upon it, forming the Basilary Artery (A. basilaris). This passes along the middle of the under surface of the pons, and divides near its anterior edge into four principal arteries, viz. the two superior arteries of the cerebellum, and the two posterior arteries of the cerebrum.

The *vertebral* gives off before entering the cranium:

α. *Branches* to the deep muscles of the neck, some that pass through the vertebral foramina, and are distributed to the membranes of the spinal marrow, and others (and these the larger) at the upper part of the neck distributed to the trachelo-mastoideus, transversalis colli, and to the recti and obliqui capitis.

After entering the cranium it gives off:

β. *Posterior artery of the spinal marrow*, a branch of small size, that passes to the posterior surface of the spinal marrow, and descends on each side along the groove of the medulla to its inferior extremity. It is extremely tortuous in its course, and during the whole of its descent is joined and augmented by branches of the vertebral, cervical, and intercostal, arteries, which pass through the vertebral foramina.

γ. *Inferior of the cerebellum* (A. cerebelli inferior). Arises from the outer side of the vertebral, and is frequently double (on one or both sides). Sometimes one or both arise from the basilary. It passes backwards and outwards between the cerebellum and medulla oblongata, distributes branches to the choroid plexus of the fourth ventricle, ascends between the lobes of the cerebellum, and furnishes branches which ramify on its pia-matral covering.

δ. *Anterior of the spinal marrow.* Comes off near the junction of the vertebral arteries, descends and unites with its fellow, forming a branch which takes its course along the anterior groove of the spinal marrow. It divides, subdivides, and anastomoses frequently during its course, forming communications with branches of the vertebral and other arteries.

Branches of the BASILARY ARTERY.

α. *Branches* from both sides, varying in size and number to the pons Varolii, and adjacent parts.

β. *Internal auditory* (A. auditiva interna), to the internal organ of hearing, after passing through the meatus auditorius internus.

γ. *Superior of the cerebellum* (A. cerebelli superior), is sometimes double on one side. It passes outwards near the anterior edge of the pons Varolii, and then over the pons backwards to the cerebellum, dividing into branches which spread on its upper surface, are continued to its posterior edge, and anastomose with the inferior branches.

δ. *Posterior of the cerebrum* (A. cerebri posterior), is much larger than the former. It passes outwards, and after sending branches to the crus cerebri, thalamus nervi optici, and corpora quadrigemina, it is joined by the communicating branch of the internal carotid. It then continues its course upwards and outwards round the crus cerebri, furnishing branches to the choroid plexus of the third ventricle, and to the parts near which it passes; then divides into branches to the posterior part of the hemisphere, especially to its under surface, to the corpus callosum and thalami, and these freely communicate with branches of the anterior and middle arteries of the cerebrum.

The other branches given off from the *subclavian* artery are:

2. INFERIOR THYROIDEAL (A. thyroidea inferior). It arises farther out than the vertebral, and is a branch of considerable, but varying, size; and the branches into which it divides are not constant. Sometimes the ascending, the supra-scapular, the superficial, and the deep cervical, branches are given off from this artery or arise from a common trunk. Occasionally it sends off the internal mammary. It passes upwards, and bends inwards behind the common carotid, seldom before it, to the thyroid

gland; then divides into a number of branches, which penetrate the under part of the gland, and anastomose with branches of the opposite inf. thyroideal, and of the superior thyroideal on the same side. It distributes branches to the longus colli, some that pass through the vertebral foramina, and others that pass to the air tube and œsophagus. The continuation of the trunk to the thyroid gland is distinguished by the name of the *thyroideal branch* (R. thyroideus). Sometimes there is a separate branch to the thyroid gland from the common carotid, from the unnamed trunk, or from the aorta (A. thyroidea ima), the last of which passes over the fore part of the trachea, and would, therefore, be in danger in the operation of tracheotomy.

3. SUPRA-SCAPULAR (A. transversa scapulæ, dorsalis superior scapulæ). It takes its course transversely outwards behind and a little above the clavicle, generally before, but sometimes behind the scalenus anticus, distributing branches to the muscles of the inferior hyoideal region and to the neighbouring muscles. It is continued to the superior costa of the scapula, passes through the notch upon the dorsum of the bone, then takes its course between the spine and glenoid cavity to the fossa infra-spinata, and anastomoses by one or more branches with the dorsal branch of the infra-scapular. It furnishes branches to the spinati muscles, to the adjacent muscles of the shoulder, and to the shoulder-joint.

4. ASCENDING CERVICAL (A. cervicalis adscendens). Ascends along the transverse processes of the cervical vertebræ between the longus colli and scalenus anticus. It distributes branches to the muscles, which are attached to the cervical vertebræ, and to those of the back of the neck; at the upper part of the neck it bends backwards, furnishing branches to the muscles under the occiput, and anastomoses with branches of the vertebral and occipital arteries.

5. SUPERFICIAL CERVICAL (A. cervicalis superficialis, transversa colli). Is commonly larger than the former, it passes nearly transversely outwards, bends backwards, and commonly divides into two branches near the superior costa of the scapula, one of which passes upwards and the other downwards. It supplies branches to muscles situated at the back part of the neck, shoulder, and chest: and communicates with branches of the occipital and vertebral.

6. DEEP CERVICAL (A. cervicalis profunda).—Arises generally farther out than the last, and after the subclavian

has passed between the scaleni muscles; it then bends upward and outward, is in part concealed in its course by the nerves which form the axillary plexus, and divides into branches principally distributed to the deep-seated muscles at the back of the neck, often furnishing a branch which passes in the direction of the base of the scapula. It sends, likewise, small branches through the vertebral foramina, and others which communicate with branches of the vertebral and occipital arteries.

The *inferior* branches are:—

7. INTERNAL MAMMARY (A. mammaria interna). It comes off from the subclavian artery nearly opposite to the inferior thyroideal branch, then descends nearly straight within the chest behind the cartilages of the ribs, near the edge of the sternum between the intercostales interni and sterno-costalis; nearly opposite to the sixth or seventh rib, it divides into two branches, the epigastric. It furnishes in its course various branches:

α. *Thymic* (R. thymici) which are distributed to the thymus gland.

β. *Pericardiac* (R. pericardiaci) which are distributed to the pericardium.

γ. *Mediastinal* (R. mediastini) which are distributed to the mediastinum.

δ. *Branch* accompanying the phrenic nerve (R. Comes nervi phrenici). Distributed principally to the diaphragm.

ε. *Intercostal* (R. intercostales), which pass outwards in the spaces between the true ribs, to which commonly they correspond in number, and after distributing branches to the intercostal muscles, anastomose with the aortic intercostals. Others pass between the ribs to the exterior of the chest, distributed to the soft parts, and to the muscles of the abdomen.

ζ. *Phrenic* (R. musculo-phrenicus), which divides into branches to the diaphragm and abdominal muscles.

η. *Epigastric* (R. epigastrici), which assist in the supply of the parietes of the abdomen and anastomose with branches of the epigastric branch of the external iliac artery.

8. SUPERIOR INTERCOSTAL (A. intercostalis suprema). It arises more outwards, and from the back part of the subclavian; and is a branch of small, but variable, size. It passes down over the neck of the first rib, sends branches to the deep muscles of the neck, some of which pass through the vertebral foramina, and then divides into two or three branches, which are distributed to the two or three uppermost intercostal spaces.

AXILLARY ARTERY.

The Axillary Artery, which is the continuation of the subclavian, passes outwards and downwards to the lower edge of the tendon of the latissimus dorsi, and there changes its name to that of the brachial artery.

The axillary artery in its course through the axilla: *Anteriorly,* is covered by the pectoralis major and minor: it is accompanied by the axillary vein, which, opposite to the head of the humerus, sinks rather below it; and at that part the nerves of the axillary plexus pass before it. *Posteriorly,* it is opposite to the space, between the serratus magnus and subscapularis muscles, filled by cellular membrane and fat; and is accompanied by the nerves forming the axillary plexus. To the *inner* side it is at first near to the second rib and serratus magnus; it is then inclined outwards from the parietes of the chest, the intervening space being occupied by fat and cellular membrane, in which several absorbent glands are placed. To the *outer* side, in its passage between the clavicle and coracoid process, are situated in part the nerves forming the axillary plexus; but these passing forwards like those from behind, it is then close to the capsular ligament of the shoulder-joint. The artery may be conveniently laid bare by carrying an incision downwards and outwards to a point opposite the coracoid process of the scapula, through the integuments and clavicular slip of the pectoralis major, then by pursuing the dissection between the subclavius and the edge of the pectoralis minor, during which the cephalic vein and branches of the humeral thoracic artery are to be avoided: the artery will be found directed outwards and downwards, with the accompanying vein before it, and the nerves of the axillary plexus behind and to the outer side.

The branches of the axillary artery are the external thoracic, the infra-scapular, and the circumflex of the upper arm. These branches present numerous varieties in number, size, and origin; chiefly in consequence of two or more arising from a common trunk. Occasionally the supra-scapular takes its origin high up from the axillary.

The External Thoracic (A. thoracicæ externæ). Are commonly three or four in number: viz.

1. Superior Thoracic (A. thoracica suprema, prima). It arises commonly nearly opposite the second rib, and takes its course downwards and forwards upon the exterior of the chest. Sometimes there are two instead of one. It is distributed to the intercostales externi, pectoralis minor, subscapularis, serratus magnus, to the axillary glands, and skin.

2. **Humeral Thoracic** (A. thoracica humeraria). It arises near the beginning of the axillary artery. Sometimes there are two branches instead of one. It divides almost immediately into branches distributed to the pectorales, to the deltoid, to the muscles about the shoulder, and to the shoulder-joint. One branch most commonly takes its course along the edge of the deltoid, between it and the pectoralis major.

3. **Long Thoracic** (A. thoracica longa, mammaria externa). It frequently arises from the infra-scapular. It passes forwards upon the chest, and supplies branches to the serratus magnus, pectoralis major, to the integuments, and in the female to the mamma.

4. **Alar Thoraçic** (A. thoracica axillaris, alaris). Is sometimes a separate branch, detached near to the humeral thoracic, and assisting in the supply of the axillary glands, pectoralis, serratus and subscapularis muscles. The external thoracic branches anastomose with branches of the intercostal arteries.

5. **Infra-Scapular** (A. infra-scapularis, subscapularis). Is, in general, the largest branch from the axillary artery. It arises, commonly, concealed by the axillary plexus, opposite the lower edge of the subscapularis muscle, along which it takes its course, but soon divides into an internal and a dorsal branch.

α. *Internal scapular* (R. scapularis internus) continues in the course of the trunk, along the under edge of the subscapularis, then passes upon the side of the chest directed downwards and backwards, and supplying branches to the subscapularis, teres major, latissimus dorsi, serratus major, and to the axillary glands.

β. *Inferior dorsal of the scapula* (R. dorsalis scapulæ inferior) gives off branches to the subscapularis, and to the teres major and minor; then passes round the neck of the scapula, between the subscapularis and teres major to the dorsum of the bone upon which it gives off many branches to the infraspinatus. The artery is then continued to the root of the acromion, where it anastomoses with the superior dorsal branch of the scapula, and thus a passage for the blood is preserved under the obstruction of the trunk of the subclavian and axillary arteries between the origin of the superior dorsal and infra-scapular branches.

There are two circumflex arteries of the arm—an anterior and a posterior.

6. **Anterior Circumflex** (A. circumflexa an-

terior, articularis anterior) is smaller than the posterior. It arises just above the edge of the tendon of the latissimus dorsi, and then passes outwards round the os humeri, between it and the common origin of the coraco-brachialis and biceps, just below the head of the bone. It sends branches upwards to the shoulder-joint and parts adjacent, some of which anastomose with the dorsal branches of the scapula; and is then continued under the deltoid muscle, supplying it with branches, by which it terminates, and which anastomose with branches of the posterior circumflex artery.

7. POSTERIOR CIRCUMFLEX (A. circumflexa posterior, articularis posterior). Is the larger of the two. It arises frequently from the infra-scapular, or from a trunk in common with the profunda humeri, and occasionally in common with the anterior circumflex artery. It passes backwards between the subscapularis and teres major, then round the os humeri, below its head, between the bone and the long head of the triceps, and is continued to the inner surface of the deltoid muscle. In its course it distributes branches to the long head of the triceps, to the shoulder-joint, teres minor, &c. and terminates by dividing into branches to the deltoid, some of which anastomose with branches of the anterior circumflex, infra-scapular, and dorsal scapular branches.

BRACHIAL ARTERY.

The BRACHIAL ARTERY (A. brachialis, humeraria) passes from the axilla to below the bend of the elbow where it terminates by dividing into the radial and ulnar arteries. During the greater part of its course it is situated to the inner side of the arm. As it descends it is placed more superficially and anteriorly; at the bend of the elbow it is opposite to the middle of the articulation.

Anteriorly:—It has first the edge of the coraco-brachialis, which more or less covers it. In the greater part of the rest of its course it corresponds, and is nigh, to the inner edge of the biceps muscle. At the bend of the elbow it is covered by the aponeurosis of the biceps muscle, and is crossed by the basilic median vein. *Posteriorly:*—It has the triceps, from which it is separated by fat and cellular membrane; passes over the os humeri, and, inferiorly, is continued down upon the brachialis internus. *To the inner side:*—It is immediately adjacent to the brachial vein and median nerve, which latter is placed rather anteriorly; it is separated from the skin by fat and cellular membrane. *To the* *outer side* :—It has the coraco-brachialis, which separates it from the os humeri: as it descends it corresponds to the biceps, and near its termination to the tendon of that muscle.

The branches which it gives off are one or two deep branches, and branches to the muscles.

1. Deep Humeral (A. profunda humeri). Arises commonly near the edge of the tendon of the latissimus dorsi; passes then outwards and downwards, accompanied by the spiral nerve, between the heads of the triceps, and behind the os humeri. It supplies numerous branches to the heads of the triceps in its course, and commonly furnishes the nutritious artery (A. nutritia) of the os humeri (which, where this is not the case, arises from the brachial itself). Its divisions anastomose with branches of the scapular and circumflex arteries. It gives off:

α. Communicating radial (*R. communicans radialis*) which passes from behind the os humeri, and is continued on its outer side as far as the outer condyle, furnishing branches to the biceps and brachialis internus, and anastomosing with the recurrent radial branch of the radial artery.

2. Inferior Deep Humeral (A. profunda inferior, minor). Comes off lower than the former. It is sometimes a branch of the profunda superior, and is then called the *communicating ulnar* (R. communicans ulnaris). It descends upon the triceps on the inner side of the arm distributing branches to it, and anastomoses below with the recurrent ulnar branch of the ulnar artery, and recurrent interosseal branch.

3. Muscular Branches, variable in size and number, and distributed to the biceps, coraco-brachialis, brachialis internus, which are given off during the course of the brachial artery.

4. Anastomotic Branch (R. anastomoticus). Arises about two inches above the elbow; passes inwards over the brachialis internus, furnishing branches both to it, and to parts about the elbow joint; inosculates behind the inner condyle with the recurrent ulnar, and thus communicates with the other anastomosing branches.

The place at which the brachial artery divides into radial and ulnar arteries has been already described as just below the bend of the elbow upon the tendon of the brachialis internus. Sometimes, though rarely, the division takes place lower down. But it frequently takes place higher up, at any point between the usual place of division and the axilla. In this latter case, the radial takes its course superficially; and the ulnar sometimes passes in the situation of the brachial artery, but occasionally superficially, being continued over the heads of the flexor muscles between the fascia and skin. Sometimes the common interossea is given off in the upper arm. Another variety is that sometimes one or more considerable additional branches (vasa aberrantia) are given off from the upper part of the brachial, and after descending superficially terminate in the lower part of the brachial, or more commonly in one of the arteries of the fore-arm, especially the radial. These varieties are found on one or both sides, more commonly on both: they are important with respect to surgical practice, as in the greater number of instances above cited they would be more exposed to injury, but would at the same time allow a more ready passage for the blood when its course through the principal trunk had been obstructed; and they would also cause difficulty in operation.

RADIAL ARTERY.

The Radial Artery (A. radialis) is commonly smaller than the ulnar, but is continued more in the direction of the brachial, and is situated more superficially. It passes down in the course of the radius as far as the wrist. During its passage through the fore-arm: *posteriorly*, it corresponds to the radius, but is separated from it above by fat, cellular membrane, and the supinator radii brevis, lower by the pronator teres; it is then situated on the flexor pollicis longus, and below upon the pronator quadratus, and on the radius itself. On the *inner side* is placed the pronator teres, flexor sublimis, and flexor carpi radialis. On the *outer side* it has the supinator radii longus, and is accompanied in part of its course by the superficial branch of the spiral nerve. *Anteriorly*, it is covered by the skin and aponeurosis of the fore-arm, from which, however, it is separated, *above*, by fat and cellular membrane, and, *below*, by the projection of the flexor carpi radialis and supinator longus at the sides; but where these muscles become tendinous the artery is immediately beneath the integuments, so that its pulsations can be readily felt. *At the wrist* it bends backwards, commonly between the trapezium and the tendons of the extensor ossis metacarpi, and extensor primi internodii, pollicis, or sometimes higher, to the space between the metacarpal bones of the thumb and fore finger. It is continued through the abductor indicis into the palm of the hand where it terminates by forming the deep-seated palmar arch.

The branches which the radial gives off are:—

1. Recurrent Radial (A. radialis recurrens). Comes off usually near the beginning of the radial, and is a branch of considerable size. It passes up on the inside of the supinator radii longus, then between it and extensor carpi radialis longior, and near the olecranon inosculates with the communicating radial branch of the deep humeral. It furnishes branches in its course to the supinatores, extensores radiales, brachialis internus, and to the elbow joint.

2. Muscular Branches (R. musculares). The radial in its course gives off numerous branches, mostly of small size, to the pronator teres, flexor carpi radialis, flexor sublimis, flexor pollicis longus, pronator quadratus, and to the wrist joint.

3. Superficial Palmar (A. superficialis volæ). Is a branch of variable size, which comes off near the wrist and passes down superficially close to the tendon of the palmaris longus to the palm of the hand. When small, or sometimes even when of considerable size, it is entirely expended on the muscles which form the ball of the thumb. When of large size it commonly joins with the ulnar in forming the superficial palmar arch; in which case, sometimes besides the branches to the muscles of the thumb, it sends a branch along its outer side, occasionally a branch along its inner side, and furnishes the radial branch of the fore finger. In some cases, the superficial branch arises high up and takes the course of the radial artery, but more superficially, so that its pulsation might be mistaken for that of the radial artery.

4. Small Branches. Distributed to the ligaments and other parts about the wrist.

5. Dorsal Branches. Variable in size and number to the back part of the carpus, metacarpus, to the interossei muscles, and to the back part of the thumb and fore-finger.

In the palm of the hand the radial artery passes inwards, is called the deep palmar branch, forming the *deep-seated palmar arch*, and joins with the deep branch of the ulnar artery. It furnishes also the

6. Large Artery of the Thumb (A. magna pollicis). This is usually given off on the metacarpal bone of the fore-finger, takes its course on the inner side of the metacarpal bone of the thumb, and either divides into two branches, one of which passes along the outer and the other along the inner side of the thumb to its extremity, or furnishes only one of these

branches, the other being supplied either from the superficial or deep palmar arch.

7. Radial Branch of the Fore-finger. (A. radialis indicis.) Passes along the outer side of the fore-finger to its extremity.

ULNAR ARTERY.

The Ulnar Artery (A. ulnaris, cubitalis) is usually a more considerable artery than the radial, and is deeper seated in its course. As it descends it bends inwards and takes its course in the direction of the ulna, is then continued into the palm of the hand, and terminates by forming the superficial palmar arch.

Anteriorly:—It is at first covered by the pronator teres, palmaris longus, flexor carpi radialis, and flexor sublimis, but lower is more superficial, being separated only from the aponeurosis and skin by the projection of the flexor sublimis and flexor carpi ulnaris at the sides. *Posteriorly*:—It is placed on the flexor profundus. *On the inner side*:—It has the flexor carpi ulnaris, and is accompanied by the ulnar nerve. *On the outer side*:—It has the flexor sublimis. *At the wrist* it has behind it the ligamentum carpi annulare, a small slip of which usually passes before it: and, on the inner side, the os pisiforme. In the *palm of the hand* it has behind it the tendons of the flexors of the fingers, and is only covered by the aponeurosis and skin.

Its branches are:—

1. Recurrent Ulnar (A. recurrens ulnaris). Is a branch of considerable size. It is commonly the first, but a smaller muscular branch sometimes is first given off. It passes upward between the sublimis and profundus, and through the flexor carpi ulnaris, furnishing branches to these muscles, as far as the hollow between the inner condyle and olecranon, and inosculates with the lesser deep and with the anastomosing branch of the brachial artery. It is sometimes, in the case of a high division, a branch of the interosseal artery.

2. Interosseal (A. interossea). Is a branch of considerable size. It is sometimes a branch of the humeral artery, and in a high division is usually given off by the radial. It furnishes one or two branches to the adjacent muscles, and then divides into two nearly equal branches, that occasionally come off separately, the anterior and posterior interosseal branches.

α. *Posterior interosseal* (R. interosseus posterior). Passes backwards above the interosseous ligament. It then gives off the *recurrent interosseal* (A. recurrens interossea) which passes upward between the radius and ulna, and inosculates upon the back part of the elbow with the other anastomosing branches of the humeral, radial, and ulnar arteries, forming with these a plexus of vessels at this part. After detaching this branch the posterior interosseal is continued downwards between the extensors of the thumb and that of the fingers, furnishing branches in its course to these muscles, and reaches as low as the wrist.

β. *Anterior interosseal* (R. interosseus anterior). Is the larger of the two; it takes its course downward upon the anterior surface of the interosseous ligament, and furnishes branches to the flexor muscles, some which perforate the interosseous ligament, and supply the extensors; it also gives off commonly the nutritious arteries of the radius and ulna. Near the edge of the pronator quadratus it passes through the interosseous ligament, and divides into branches which, upon the back of the carpus and hand, anastomose with branches of the posterior interosseous and dorsal branches of the radial and ulnar arteries, forming with these a plexus, from which branches pass to the back part of the hand and fingers.

3. Muscular (R. musculares). The ulnar, like the radial artery, furnishes numerous branches in its course along the fore-arm to the adjacent muscles, the flexor carpi ulnaris and flexors of the fingers.

4. Dorsal (A. dorsalis ulnaris). Comes off near the extremity of the ulna, passes backward under the tendon of the flexor carpi ulnaris, and after furnishing branches to the adjacent parts, joins with the branches which form the plexus at the back of the wrist.

5. Deep Ulnar (A. ulnaris profunda). Passes deep into the palm round the flexor of the little finger, is continued outwards, and inosculates with the radial forming the deep palmar arch, situated near the bases of the metacarpal bones. It furnishes interosseal branches to the interossei muscles, which anastomose at the roots of the fingers with the digital branches of the superficial arch, and other branches which pass between the metacarpal bones to the back of the hand.

The ulnar artery then passes outward over the tendons of the flexor muscles, and forms the *superficial palmar arch* (arcus superficialis volæ). This is placed with its convex side downwards, and anastomoses frequently with the superficial palmar branch of the radial on the outer side of the hand or with the large artery of the thumb. It furnishes branches to the fingers, called

6. **Digital** (A. digitales). Which consist of

α. Branch which passes along the inner side of the little finger.

β. Three considerable branches which arise in succession, and pass to the interstices between the fingers, where each divides into two branches, one of which passes along the outer or radial side of one finger, and the other passes along the inner or ulnar side of the finger next to it; so that the first supplies the little and ring fingers, the second the ring and middle fingers, and the third the middle and fore fingers. There are several varieties in their size and origin, but not usually in the mode of distribution above indicated. After giving off in their course small branches to the fingers, they divide and form an intricate plexus at the tip of each finger.

The superficial arch sometimes supplies the branches to the thumb and fore finger usually given off from the radial artery.

§ 3. BRANCHES FROM THE THORACIC PORTION OF THE AORTA DESCENDENS.

Numerous branches are given off from the aorta in its passage through the chest, but they are so inconsiderable that the aorta is not sensibly diminished in size. These vessels are subject to frequent varieties. They are:—

1. **Bronchial** (A. bronchiales). These vary considerably in number and size. The right upper is commonly a branch of the uppermost aortic intercostal; but sometimes arises immediately from the aorta. The left arises about an inch below the arch of the aorta; it is the larger of the two, and usually sends a branch to the right bronchus. There are sometimes one or two inferior. Occasionally there is only one bronchial artery. The bronchial arteries give off branches to the œsophagus, the mediastinum and the pericardium, and accompany the bronchia into the lungs.

2. **Œsophageal** (A. œsophageæ). Are small branches variable in size and number distributed to the œsophagus and adjacent parts.

3. **Mediastinal** (A. mediastinales). Are small branches distributed to the œsophagus, to the mediastinum, and to the aorta itself.

4. **Intercostal** (A. intercostales). They supply chiefly the intercostal spaces, but do not correspond to these in number in consequence of the uppermost space or spaces being supplied by the intercostal branch of the subclavian artery; and

in consequence of two sometimes, especially the uppermost, arising by a common trunk: they commonly consist of eight pairs. They arise from the back part of the aorta at a more or less acute angle, the angle becoming more obtuse inferiorly. They pass upwards round the bodies of the vertebræ to the corresponding intercostal spaces; the right arteries from the position of the aorta having the longer course. Near the head of each rib they send a branch backwards, which divides into branches to the muscles lying near the spine, to the spinal marrow, which pass through the vertebral foramina, and to the muscles on the exterior of the chest. They are then continued forwards in the grooves at the under edges of the ribs between the two layers of intercostal muscles, and furnish branches to the intercostal muscles, to the muscles on the exterior of the chest, abdominal muscles, to the pleura, and to the diaphragm, and form communications with the intercostal branches of the internal mammary, and with branches of the epigastric and external thoracic arteries. The last is, excepting the first, the largest; it passes behind the crus of the diaphragm, and divides upon the quadratus lumborum into branches to this muscle, and to the abdominal parietes: these branches descend as far as the spine of the ilium, and have several communications with the lumbar and circumflex arteries.

§ 4. BRANCHES FROM THE ABDOMINAL PORTION OF THE AORTA.

The branches given off from the aorta during its passage through the abdomen are much more considerable than those which arise from it in the chest. They may be divided into those which arise singly, and those which arise in pairs.

Of those which arise singly, there are three considerable arteries, usually called the three *azygous branches* of the abdominal aorta, the cœliac, the superior mesenteric and the inferior mesenteric. They are distributed entirely to the chylopoietic viscera.

1. Cœliac.

The Cœliac (A. cœliaca) arises from the aorta as soon as it has passed into the abdomen between the crura of the diaphragm, and is placed near the upper edge of the pancreas. It forms a short trunk which soon divides into three branches—the coronary of the stomach, the hepatic, and the splenic.

1. Coronary of the Stomach (A. coronaria ventriculi, gastrica superior) is usually the smallest of the three.

It frequently arises in common with one or both cœliac arteries. It takes its course upward and to the left to the cardia of the stomach, giving off several branches to the œsophagus, cardia, and to the adjacent parts of the stomach. It is then continued along the less curvature of the stomach towards the pylorus, furnishing considerable branches in its course, which descend upon the anterior and posterior surfaces of the stomach for the supply of its coats, and sending small branches to the omentum minus. The coronary frequently gives origin to the left hepatic branch.

2. HEPATIC (A. hepatica) is larger than the former. It sometimes arises from the aorta, or in more rare instances from the superior mesenteric: sometimes it arises by two branches, one of which only is from the coronary or superior mesenteric. It takes its course to the right, then, upwards and forwards, passes through Glisson's capsule to the porta of the liver, a little below which it divides into a right and left hepatic branch. Before its division it gives off:—

A. RIGHT INFERIOR GASTRIC (A. gastrica dextra inferior). It passes downward and to the left between the duodenum, the pylorus, and the pancreas, to the greater curvature of the stomach, along which it is continued between the layers of the omentum to the left, and anastomoses with the left inferior gastric branch of the splenic. It furnishes the following branches:

α. *Duodenal* (R. duodenales), consisting of one or two branches distributed to the duodenum and pylorus.

β. *Pancreatic* (R. pancreatici), distributed to the right extremity of the pancreas.

γ. *Epiploic* (R. epiploici), long, but slender branches, which descend between the layers of the omentum.

δ. *Gastric* (R. gastrici) branches which ascend upon the surfaces of the stomach and are distributed to its coats.

B. PYLORIC (A. pylorica, gastrica dextra superior). Sometimes given off before the inf. gastric branch, or from that vessel. It descends upon the pylorus, furnishes branches to it and to the adjacent parts, and anastomoses with the coronary upon the lesser curvature of the stomach.

The hepatic artery then divides into:

C. RIGHT HEPATIC (A. hepatica dextra). It is larger than the left, supplies the right lobe of the liver, and furnishes the

α. *Cystic branch* (A. cystica), which passes upon the gall-bladder, frequently dividing into two branches, and is distributed to its coats.

D. LEFT HEPATIC (A. hepatica sinistra). Supplies the left lobe of the liver.

3. SPLENIC (A. splenica, lienalis). Commonly the largest of the branches from the cœliac, takes its course to the left behind the stomach, and along the upper edge of the pancreas, as far as the fissure of the spleen, opposite to which it divides into several large branches, which are distributed to the substance of the spleen. It furnishes in its course:—

α. *Pancreatic* (R. pancreatici), several in number, which descend inclined to the left upon the pancreas, and send branches into its substance.

β. *Short gastric* (A. gastricæ breves), five or six in number, given off where the artery divides, which are distributed upon the left extremity of the stomach, and form numerous communications with the coronary and right gastric branches.

γ. *Left inferior gastric* (A. gastrica inferior sinistra). Arises from the same part as the last, but is of larger size. It takes its course along the greater curvature of the stomach, furnishing branches to the coats of the stomach and to the omentum, and anastomoses with the right inferior gastric branch.

II. SUPERIOR MESENTERIC ARTERY.

1. SUPERIOR MESENTERIC (A. mesenterica superior). Is generally larger than the cœliac. It arises from the aorta, immediately below the cœliac, and sometimes by a trunk in common with it. It is first concealed by the pancreas, behind which it descends, then passes over the duodenum, and takes its course between the layers of the mesentery downwards and to the left, forming a bend of which the concavity is upwards and to the right, and the convexity downwards and to the left, and, gradually diminishing in size, terminates in the right lumbar region. Its first branches are small, distributed to the pancreas and duodenum, and communicate with branches of the hepatic. The principal branches are for the supply of the small and large intestines.

1. BRANCHES TO THE SMALL INTESTINES (A intestinales). They arise from the convexity of the bend, and are ten or eleven in number: those which are towards the middle, being the longer. But in size they all decrease from above to below. They take their course between the layers of the mesentery, furnishing small branches both to these and to its glands. They then

ramify, and the branches, by uniting, form arches, the convexity of which is towards the intestines. From these, again, branches proceed, which unite and form similar smaller arches, and these again detach numerous yet smaller branches, which likewise freely communicate with each other; so that the distribution of these vessels has the appearance of a network. From the arches nearest the intestines, numerous small branches pass in a straight direction to the anterior and posterior surfaces of the intestines, and are distributed to their coats, in which they freely anastomose with each other.

From the concavity of the bend are arising the arteries which supply the large intestines. They are two or three in number, are called the *colic arteries* (A. colicæ), and are distinguished as the:—

2. ILIO-COLIC BRANCH (A. ilio-colica, colica inferior dextra). It arises the lowest, and passes downwards, and to the right. It detaches a branch which forms, in part, a communication with that portion of the superior mesenteric that supplies the ilium, and is, in part, distributed to the appendix cæci. It then divides into two branches, one of which descending, supplies the cœcum and adjacent parts of the ilium, the other ascends in the course of the ascending colon, distributing branches to its coats.

3. RIGHT COLIC BRANCH (A. colica dextra), the smallest of the three branches. It frequently arises by a trunk in common with the colica media, and sometimes in common with the ilio-colic. It soon divides into two branches, one of which ascends to join with a similar branch of the middle colic, and the other, the larger, descends to join with the ascending branch of the ilio-colic. Both distribute branches to the colon.

4. MIDDLE COLIC BRANCH (A. colica media, superior dextra). Arises a few inches from the origin of the trunk of the superior mesenteric, passes towards the middle of the arch of the colon, and divides into two branches, one of which passes to the right, and joins with the ascending branch of the right colic, and the other larger one is continued to the left, and joins with a similar branch of the ascending branch of the inferior mesenteric. Both give off branches to the upper part of the ascending and right portion of the arch of the colon.

III. INFERIOR MESENTERIC ARTERY.

1. INFERIOR MESENTERIC (A. mesenterica inferior). Arises commonly about an inch above the bifurcation of the aorta. It takes its course obliquely downwards and to the

left, and divides into branches to the left portion of the colon and to the rectum.

1. LEFT SUPERIOR COLIC (A. colica sinistra superior, ramus ascendens). Ascends in the course of the descending colon, and divides into two branches, one of which joins with the left branch of the middle colic, and the other with the ascending branch of the left inferior colic. Both send branches to the arch of the colon and its descending portion.

2. LEFT INFERIOR COLIC (A. colica inferior sinistra). Divides like the former into two branches, one of which joins with the descending branch of the left superior colic, and the other with a branch of the internal hæmorrhoidal. They supply the descending colon and its sigmoid flexure. There is sometimes a third left colic.

3. INTERNAL HÆMORRHOIDAL (A. hæmorrhoidea interna) is the continuation of the trunk. It sends off a branch to the left to join (as has been already indicated) with a branch of the left inferior colic, and then descends upon the back part of the rectum, dividing into numerous branches, distributed to its coats, which freely communicate, and anastomose with the other branches distributed to this gut.

The *branches* which arise *in pairs* from the aorta are the diaphragmatic, renal, spermatic, and lumbar.

1. DIAPHRAGMATIC (A. diaphragmaticæ). They arise separately, or by a common trunk, from the aorta, as soon as it enters the abdomen, often, and, according to some, most often from the cœliac. Sometimes, however, one only is given off from the cœliac. They pass upward and outward over the crura of the diaphragm, furnishing branches to the crura and glandulæ renales, and then spread into branches upon the under surface of the greater muscle, the middle of which they principally supply, anastomosing with the other branches distributed to the diaphragm.

2. RENAL (A. renales, emulgentes). Are branches of large size. They arise from the side of the aorta, usually nearly opposite to each other, just below the origin of the superior mesenteric. They pass outwards and a little downwards, over the body of the first or second lumbar vertebra to the sinus of the kidney, opposite to which they divide into three or four branches, which again subdivide, pass into the substance of the

kidney, and ramify in the cortical part. They vary frequently in size and in *number*, from one to four on one or both sides, according to the size and situation of the kidney. The right, from the situation of the aorta, is the longer of the two, and passes commonly behind the vena cava inferior. They furnish branches to the ureter, and frequently a larger branch to the renal gland (A. CAPSULARIS), which besides supplying the renal gland or capsule, furnishes branches to the crus of the diaphragm and lumbar glands.

3. SPERMATIC (A. spermaticæ, seminales). They are of small size, but occasionally have a double origin. They arise from the fore part of the aorta, a little below the renal arteries, but often lower, and generally not opposite to each other. Occasionally one arises from the renal, and very rarely from any other artery. They take their course outwards and downwards on the psoas muscles, behind the peritonæum and before the ureters; and the right before the vena cava inferior. In the female they are shorter than in the male, pass between the layers of the broad ligaments, and are distributed to the ovaria, to the fallopian tubes, and the upper part of the uterus, upon which they anastomose with the other uterine arteries. In the male they are continued to the inguinal canal, where they assist in forming the spermatic cord, and in it pass, and are distributed, to the testicle. They furnish branches in their course to the ureters and adjacent parts.

4. LUMBAR (A. lumbales). Those from the aorta are commonly four in number on each side, the fifth being usually supplied from the iliac, or from the middle sacral artery. Sometimes there are only three, in consequence of the lowermost arising by a common trunk. They come off more from the back part of the aorta; then take their course backward, round the bodies of the lumbar vertebræ, as far as the roots of the transverse processes, under the psoæ muscles, to which, as well as to the quadrati, they furnish branches. At the roots of the transverse processes each sends a branch backward (R. dorsalis), distributed to the muscles lying near the spine, and to the spinal marrow by a branch passing through the vertebral foramina. They are then continued forwards to supply the abdominal muscles, and form communications with branches of the epigastric artery.

§ 5. BRANCHES FROM THE TERMINATION OF THE AORTA.

The aorta commonly terminates upon the fourth, or between the fourth and fifth lumbar vertebra, by dividing into two large, constant, and corresponding branches, called the common iliac arteries (A. iliacæ communes, primitivæ); and a third small azygous, and not constant branch, called the middle sacral (A. sacra, sacralis media). These branches supply the lower part of the trunk and lower extremities.

Middle Sacral (A. sacralis media). Is a small branch which arises from the back part of the aorta, at its bifurcation; but is sometimes a branch of the common iliac. It descends over the body of the last lumbar vertebra, thence along the middle of the sacrum and os coccygis, and is lost upon the adjacent parts and back part of the rectum. In its course it gives off commonly a branch on each side to form the fifth lumbar arteries; it next detaches on each false vertebra commonly a pair of branches, which pass outwards, are distributed to the sacrum, send branches through the sacral foramina to the spinal canal, and form communications with the lateral sacral arteries.

COMMON ILIAC ARTERY.

The Common Iliac Arteries (A. iliacæ communes primitivæ) come off at an acute angle, and are continued outward and downward over the last lumbar vertebra. The right passes commonly before the left common iliac vein, the left before and to the outer side of the same vein. About opposite to the sacro-iliac symphysis they each terminate by dividing into the internal and external iliac arteries. The right is commonly a little longer than the left. In their course they furnish only small branches to the adjacent parts.

INTERNAL ILIAC ARTERY.

The Internal Iliac Artery (A. iliaca interna, hypogastrica) passes downwards into the cavity of the pelvis, and soon divides into several branches of various sizes. These vary considerably in their mode of origin; sometimes coming off immediately from the trunk, and sometimes by trunks common to two or more. They supply the contents and parietes of the pelvis, and muscles attached to it: and are the

1. Ilio-Lumbar (A. ilio-lumbalis). Commonly the first branch. It passes transversely outwards under the psoas muscle, and near the sacro-iliac symphysis, and usually divides into two branches: one of which takes its course upwards, and anastomoses with the last lumbar, or takes its place, and furnishes branches which pass through the last vertebral foramen: the other

is distributed to the psoas, iliacus and to the ilium, and communicates with branches of the lumbar and circumflex arteries.

2. Lateral Sacral (A. sacræ laterales). Generally consists of two or three branches, sometimes furnished by the ilio-lumbar, or gluteal arteries: sometimes formed by a single artery, which then divides into these branches. The lateral sacral arteries furnish *anterior* branches, which pass across the sacrum, distributing branches to it, and inosculate with branches of the middle sacral; and *posterior* branches, which enter the anterior sacral foramina, distribute branches to the cauda equina, and send branches through the posterior foramina to be distributed to the under part of the muscles of the back.

3. Obturator (A. obturatoria). Varies considerably with respect to its origin; most commonly it arises directly from the trunk of the internal iliac, or in common with the ilio-lumbar; but frequently from the external iliac by a trunk of variable length, in common with the epigastric branch of the external iliac; occasionally from the external iliac itself; and still more rarely from the femoral. When it arises from the epigastric, it passes downwards over the body of the os pubis. If it be a branch of the internal iliac, it takes its course forwards, immediately under the brim of the pelvis to the obturator foramen. It is continued through the upper part of the ligamentous expansion which fills up that opening to the upper and inner part of the thigh. In its passage through the pelvis it furnishes branches to the levator ani, and obturator internus muscle, and to the pelvic glands. It divides near the obturator foramen, usually into two branches, one of which distributes twigs to the hip-joint and adjacent muscles, and the other furnishes branches to the obturator externus, and muscles at the inner and upper part of the thigh, and anastomoses with the internal circumflex artery.

4. Gluteal (A. glutea, iliaca posterior). Sometimes arises by a trunk in common with the ischiatic. It sends off in some instances the lateral sacral, the obturator and other branches usually given off from the internal iliac. It passes downwards and outwards through the upper part of the notch of the ilium, furnishing branches to the iliacus and pyriformis muscles, then bends round the edge of the bone, is directed upwards, and divides into two principal branches, the superficial and the deep. The *superficial* passes forwards, between the gluteus maximus and medius, furnishing branches to both, to the pyriformis and to the back part of the sacrum, which anastomose with branches of the lateral sacral. The *deep* passes under the

gluteus medius, is distributed to the two lesser glutei, to parts about the hip-joint, and communicates with branches of the ischiatic and sacral arteries. Some extend as far as the fore part of the thigh, and anastomose with branches of the femoral.

5. Ischiadic (A. ischiadica). Frequently arises by a trunk, in common with the internal pudic artery, or with the gluteal. It descends inclined forwards from the gluteal artery, passes out of the pelvis below the pyriformis muscle, and is continued in the hollow between the tuberosity of the ischium and trochanter major. Whilst within the pelvis, it detaches branches to the pyriformis, obturator internus, and levator ani muscle. Exterior to the pelvis it sends numerous branches to gluteus maximus, to parts about the os coccygis, to parts situated about the back part of the hip-joint, and at the upper and back part of the thigh; and these branches communicate with the circumflex arteries.

6. Pudic (A. pudenda interna, communis). It descends within the pelvis, immediately before the ischiadic artery, and passes out of the pelvis with it before the pyriformis muscle. It then takes its course forwards between the sacrosciatic ligaments, and re-enters the pelvis. It is continued along the ischium, in the hollow above the tuberosity of that bone, and ascends on the inner side of the ramus of the ischium, and on that of the os pubis, in its course upwards advancing and becoming more superficial, to the under part of the symphysis pubis, where it terminates by dividing into branches, distributed to the organs of generation. This is the usual course, but in some instances in the male, it passes forwards at the under and lateral part of the bladder to the ischium. It furnishes,

α. *Branches* within the pelvis, to the bladder, to the vesiculæ seminales and prostate gland, and, in the female, to the vagina.

β. *Branches* to the muscles and parts adjacent to the sacro-sciatic ligaments, and hip-joint.

γ. *External hæmorrhoidal* (A. hæmorrhoidea externa). Consisting of one, sometimes of two branches, distributed to the extremity of the rectum, and to the parts about the anus.

δ. *Perineal* (A. superficialis perinei). Passes under the transversus perinei, and is continued forwards between the bulb and crus of the penis, and distributes branches to the skin and muscles of the perineum, and to the scrotum; and in the female to the labia.

ε. *Artery of the bulb* (A. bulbi urethræ, transversa perinei). Passes obliquely across the fore part of the perineum, along the transversus perinei muscle; and after furnishing several inconsiderable branches to the adjacent parts, passes into the bulb, and is distributed within the corpus spongiosum.

The trunk of the pudic is then continued as the proper artery of the penis (A. penis) in the male, and as the artery of the clitoris (A. clitoridea) in the female: and under the symphysis pubis it, in both sexes, divides into a superficial and deep branch.

ζ. *Superficial* (A. dorsalis vel superficialis penis vel clitoridis). Passes through the suspensory ligament, and takes its course along the dorsum of the penis in a tortuous direction, as far as the glans. It gives off branches to the skin and ligamentous covering of the penis, and passes into the substance behind the glans.

η. *Deep* (A. profunda penis vel clitoridis). Passes into the crus penis, and is continued forward through the corpus cavernosum, dividing in its course into numerous branches, which freely communicate with those of the opposite side.

7. UMBILICAL (A. umbilicalis). In the fœtus it is the continuation of the internal iliac, and is an artery of large size. But after birth it contracts and remains pervious only as far as the bladder. It passes forwards at the side and upper part of the bladder, towards the parietes of the abdomen, and at its beginning sends off one or two branches to the bladder.

8. VESICAL (A. vesicales). Consist of one or more branches from the internal iliac, internal pudic, and umbilical arteries, which descend to the under and back part of the bladder, and are distributed to the bladder, to the prostate gland, and vesiculæ seminales in the male, and to the vagina in the female.

9. MIDDLE HÆMORRHOIDAL (A. hæmorrhoidalis media). Is sometimes a branch from one of the divisions of the internal iliac, and sometimes is wanting altogether. It supplies branches to the fore part of the rectum, and forms communications with the other hæmorrhoidal branches.

10. VAGINAL (A. vaginalis). Is not a constant branch, but is frequently supplied from one of the other pelvic arteries. It is distributed to the vagina and bladder.

11. UTERINE (A. uterina). It takes its course to the upper part of the vagina, and detaches one or two branches to the vagina and bladder, then ascends at the side of the uterus, between the layers of the broad ligament. It is tortuous in its

course. It divides into branches to the uterus, some of which pass to its appendages; and it anastomoses with branches of the spermatic artery.

EXTERNAL ILIAC ARTERY.

The External Iliac Artery (A. iliaca externa) passes forwards from the internal iliac, takes its course outwards and downwards along the psoæ muscles, accompanied by the corresponding vein, which is situated behind and to its inner side, and covered by the peritonæum. It passes behind Poupart's ligament, and changes its name to that of the femoral artery. After furnishing some unimportant branches to the psoas and iliacus muscle, it gives off near Poupart's ligament the epigastric and circumflex arteries.

1. Epigastric (A. epigastrica). It arises commonly from the inner side of the external iliac, immediately above Poupart's ligament; but sometimes higher. It comes off not unfrequently, as has been already described, by a trunk in common with the obturator artery; occasionally from the femoral, and in some rare cases, from the common iliac or deep artery of the thigh. It first passes a little downwards, then bends upwards, and is directed obliquely inwards and upwards towards the back part of the rectus muscle, crossing the spermatic cord or round ligament, and is situated to the inner of the internal abdominal ring. In an oblique inguinal hernia it is situated to the inner side of the mouth of the sac, and would therefore be endangered by directing an incision, for liberating the stricture, inwards : in a direct inguinal hernia it is placed on the outer side of the mouth of the sac, and might therefore be divided by carrying an incision outward. In a femoral hernia it is situated above and to the outer side, so as not to be easily endangered, except where it arises from the femoral artery. For in this case it might be wounded by carrying an incision outwards.

Having reached the back part of the rectus muscle about midway, between the umbilicus and pubes, it then ascends nearly perpendicularly upwards, between the muscle and posterior layer of its sheath ; divides commonly into two branches near the umbilicus, detaching branches to the fore part of the abdominal muscles, and terminates above the navel by forming anastomoses with the epigastric branch of the internal mammary, and the lower intercostal arteries. Near the internal ring it sends off—

a. A branch, which after detaching a branch to form a communication with the obturator, passes upon the spermatic cord, or round ligament, and is distributed upon it.

2. **Circumflex of the Ilium** (A. circumflexa ilii). Arises commonly nearly opposite to the epigastric, but sometimes a little higher or lower than that artery, from the outer side of the external iliac. It bends upwards and outwards to the spine of the ilium, in the course of which it runs from before to behind, between the transverse and internal oblique muscles. It furnishes branches in its course to the iliacus, sartorius, and broad abdominal muscles, and forms communications with the epigastric and ilio-lumbar arteries. It sometimes detaches a considerable branch, which takes its course inwards and upwards, and is distributed on the fore part of the abdominal parietes.

FEMORAL ARTERY.

The **Femoral Artery** (A. femoralis, cruralis) passes from behind Poupart's ligament, where it commences, and takes its course downwards on the anterior, then on the inner side of the thigh, and at the upper part of the lowest third of the thigh passes through the tendon of the adductor magnus, and receives the name of popliteal artery.

The portion of this artery, which is opposite Poupart's ligament, is sometimes distinguished by the name of the *inguinal artery* (A. inguinalis). It passes there into the sheath formed by the fascia transversalis and fascia iliaca; it is situated nearly opposite to the junction of the ilium with the os pubis, upon the inner edge of the psoas muscle, with the accompanying vein on the inner side, and the anterior crural nerve on the outer side at a little distance from it, and exterior to the sheath in which the artery is contained.

As it descends it is first situated superficially. *Anteriorly:* it is first covered by the integuments, aponeurosis, inguinal glands, some fat and the fascia lata in the triangular space formed by the crural arch above; by the sartorius on the outer side, and the adductor longus and gracilis muscle on the inner side. Lower, the sartorius, which is gradually inclined towards it, passes obliquely over it, and continues upon it as far as the tendon of the adductor magnus, so as to cover it during its course through the middle third of the thigh. *Posteriorly,* it is opposite to the head of the os femoris, and passes down upon the under end of the psoas and iliacus muscles, and then upon the adductor brevis and magnus muscle, more or less fat and cellular membrane being interposed; but it is close upon the last named muscle below. On the *outer side,* after quitting the psoas, it is applied to the vastus internus muscle, which separates it below from the os femoris. One branch only of the anterior crural nerve accompanies it, namely the saphænus, situated at the outer and fore part, and more or less involved in its sheath. On the *inner side* it is accompanied by the femoral vein, which, as it descends, is inclined behind the artery, and is applied to the adductor, towards which it passes in its descent.

In the uppermost third of the thigh it is loosely connected to the surrounding parts. In the middle third it is surrounded by muscles, and more closely connected, and is more or less adjacent to the os femoris, so that it may be readily compressed. At the groin likewise, from its vicinity to the bone and from its superficial situation, it admits easily of compression, so that pressure applied about midway between the anterior and superior spinous process of the ilium, and the spinous process of the os pubis, will, by obstructing the artery, command any hæmorrhage from the vessels below.

The branches of the femoral are:

1. External Epigastric. Given off close to Poupart's ligament, which ascends on the fore part of the external oblique, under the skin, and is distributed to the superficial parts.

2. External Pudic (A. pudicæ externæ). One or two branches which pass inwards under the skin, and are distributed to the skin of the parts of generation, and adjacent parts. There are, besides, usually several small branches to the skin, muscles, and absorbent glands.

3. Deep Artery of the Thigh (A. profunda femoris). A branch of large size which comes off from the inner and back part of the femoral artery, usually from one to two inches below Poupart's ligament, but occasionally lower, or sometimes higher and close to it, and in some rare cases above it. It is concealed at its origin by the trunk of the femoral artery. It takes its course downwards and backwards, inclined from the femoral artery, passes between the adductor and vastus internus muscles, and terminates at the back part of the thigh. It gives off the following branches:

α. *Internal circumflex* (A. circumflexa interna). Arises commonly higher than the external, and sometimes from the femoral before the deep artery is given off. It takes its course backwards, between the extremity of the psoas and the pectineus muscles, and bends round the neck of the os femoris. It furnishes branches to the pectinalis, psoas, iliacus, and triceps. It next sends off an ascending branch, which distributes branches to the obturator, and upper part of the triceps muscles, a branch of communication with the obturator artery, and a branch which enters the acetabulum, and supplies the joint. The continuation of the internal circumflex distributes branches to the muscles in the ischiadic region, and to the upper back part of the thigh, and forms anastomoses with branches of the gluteal, ischiadic, and external circumflex arteries: these anastomosing branches are found much enlarged when the external iliac artery has been tied.*

β. *External Circumflex* (A. circumflexa externa). Arises commonly from the outer side of the deep artery nearly opposite the former, but often lower, and more rarely from the femoral. It takes its course outwards under the rectus and over the fore part of the os femoris, and divides into two principal branches. One which is continued in the direction of the trunk bends round the trochanter major, furnishes branches to the gluteus medius principally and adjacent parts, and forms communications with the internal circumflex, gluteal, and ischiadic arteries, which are enlarged after the operation of tying the external iliac artery. The other branch is more considerable. It descends on the posterior surface of the rectus, and divides into branches to the rectus, crureus, and vastus externus muscles, and one commonly descends on the vastus to the knee.

The *profunda* after detaching the circumflex arteries passes through the adductor magnus and divides into the *rami perforantes;* sometimes it passes down before that muscle and gives these branches off successively, and the arteries then pass through that muscle to the back of the thigh. There are usually two, but sometimes more, occasionally as many as five, perforating branches, distributed chiefly to the muscles at the inner and back part of the thigh.

γ. *First perforant* (A. perforans prima). Passes through the triceps a little below the trochanter minor, and commonly divides into two branches. One of which ascends behind the trochanter major, forms communications with the external circumflex, and distributes branches to the gluteus maximus, which communicate with branches of the gluteal. The other branch bends outwards round the thigh-bone, and supplies branches to the vastus externus and biceps muscles, and to the bone.

δ. *Second perforant* (A. perforans secunda magna). Is larger than the former. It passes backward, and is divided into branches to the flexors of the leg principally and to the adductor and vasti muscles. The perforating branches are subject to considerable varieties. Their branches freely communicate with each other; the upper with branches likewise of the gluteal and circumflex, and the lower with branches of the popliteal and femoral; so that these branches are found considerably enlarged when the trunk* of the femoral artery has been obstructed.

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* See A. Cooper's account of the anastomoses of the arteries at the groin. (Medico-Chirurg. Transact. vol. iv. p. 425.)

4. Muscular Branches. The femoral artery in the rest of its course after having given off the deep artery furnishes various but inconsiderable branches to the muscles and skin at the inner and fore part of the thigh.

5. Anastomotic Branch (R. anastomoticus). Is sent off just before the artery passes through the tendon of the triceps; and takes its course downward and forward upon the vastus internus muscle; upon which it divides into branches, some of which anastomose with the arteries at the upper and outer part of the knee.

POPLITEAL ARTERY.

The Popliteal Artery (A. poplitea) takes its course obliquely downward and outward, and reaching as low as the edge of the popliteus muscle, terminates by dividing into the anterior and posterior tibial arteries. In the greater part of its course it is deep-seated owing to the projection of the muscles at the sides which bound the ham. *Posteriorly.* It is covered in the greater part of its course by the popliteal vein and tibial nerve, the latter being the most superficially situated and corresponding to the edge of the semi-membranosus; fat and cellular membrane are interposed between it and the integuments, but it is connected at the upper part of the leg with the gastrocnemii and plantaris. *Anteriorly.* It is only separated from the os femoris, and lower from the capsule of the knee-joint, by fat and cellular membrane, and below it is applied to the popliteus muscle. *On the outer side.* It is first contiguous to the biceps, and is then placed close to the outer head of the gastrocnemius externus. *On the inner side.* It has the semi-membranosus and lower down the inner head of the gastrocnemius externus muscle. In the whole of its course it is embedded in fat, and in a loose cellular structure. Above, it is surrounded by muscles, though only loosely connected with them; but below it is firmly embraced by thick and strong muscles. Although it is placed so near to the thigh-bone, it would be with difficulty compressed on account of the projection of the muscles at the sides; and such compression must act first on the tibial nerve. Its branches are :—

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* See A. Cooper's Account of the dissection of a limb on which the operation for popliteal aneurism had been performed in the Med. Chir. Trans., vol. ii. p. 251.

1. SMALL BRANCHES to the flexors of the leg.

2. SUPERIOR OUTER ARTICULAR (A. articularis superior externa). It bends outwards and forwards round the os femoris, above its outer condyle, between it and the biceps flexor cruris to the vastus externus. It furnishes branches to the biceps, to the interior of the knee-joint, and to the vastus externus; and its branches anastomose with those of the opposite upper articular, those of the lower articular on the same side, and with the descending branch of the femoral artery.

3. SUPERIOR INNER ARTICULAR (A. articularis superior interna). It sometimes arises by a trunk in common with the former, and generally higher; but in some instances from the femoral artery, in which case it descends along the edge of the vastus internus. It bends inwards, forwards round the os femoris, above the inner condyle, between it and the semi-membranosus and semi-tendinosus muscles, and the tendon of the adductor magnus, and ramifies to the adjacent muscles, and to the knee-joint, by branches which form communications with the superior and inferior inner articular arteries, and with the anastomosing branch of the femoral artery.

4. MIDDLE ARTICULAR (A. articularis media, azyga). Is frequently a branch of one of the superior articular. It passes downwards between the condyles, and is continued to the knee-joint, to which it is principally distributed, anastomosing with branches of the other articular arteries.

5. INFERIOR OUTER ARTICULAR (A. articularis inferior externa). Comes off nearly opposite to the joint, passes downwards and outwards and then forwards between the external lateral ligament and the capsule of the joint. It furnishes branches to the gastrocnemius and knee-joint, and ramifies at the under and fore part of the knee, forming communications with the upper outer, and inferior inner, articular arteries.

6. INFERIOR INNER ARTICULAR (A. articularis inferior interna). Comes off near the former, and descends inward, and then forward immediately under the head of the tibia, covered by the inner head of the gastrocnemius. It furnishes branches to the joint and popliteus muscle, and is spread into branches at the under and fore part of the knee, which anas-

tomose with the opposite lower articular, and with the upper articular on the same side.

7. Surales: Branches to the Gastrocnemius Muscle (A. surales). Arise from the back part of the artery above the inferior articular. They are commonly two in number, whence they have been sometimes called, *gemellæ*; and are distributed to the heads of the gastrocnemius externus and plantaris muscles.

8. There are usually several other but small and unimportant branches from the popliteal artery.

ANTERIOR TIBIAL ARTERY.

The Anterior Tibial Artery (A. tibialis antica), sometimes comes off higher than the part before described. It passes forward through the upper part of the interosseous ligament, and then descends on the anterior surface of the ligament, first between the tibialis anticus and extensor longus digitorum muscles, and, lower, between the former muscle and the extensor proprius pollicis, accompanied by a branch of the peroneal nerve, situated on its fore part, and by the accompanying veins. During this part of its course, it is deep-seated, separated from the skin by the projection of the muscles at the sides, and by the aponeurosis of the leg. At the lower part of the leg it takes its course upon the fore part of the tibia, is crossed by the flexor longus pollicis, and becomes more superficial. It is continued then behind the annular ligament to the upper and inner part of the foot, along which it proceeds as the artery of the foot (A. pedis), on the outer side of the tendon of the flexor pollicis, to the space between the metatarsal bones of the first and second toe, and there divides into a dorsal branch of the great toe and the deep anastomotic branch. The artery of the foot is sometimes continued from the posterior tibial or peroneal artery. Its branches are:—

1. Anterior Recurrent (A. recurrens anterior). Arises after the artery has passed through the interosseous ligament. It takes it course upward upon the anterior surface of the head of the tibia, distributes branches to the tibialis anticus, and fore part of the knee-joint, and forms communications with the inferior articular arteries.

2. Muscular. Numerous but small branches which pass off laterally to supply the muscles and skin at the fore part of the leg.

3. **Malleolar** (A. malleolaris externa et interna). Two small branches given off near the under end of the tibia, but variable as to size and origin, distributed to the parts about the inner and outer ankle.

4. **Tarsal** (A. tarsea). Arises from the outer side of the artery near the ankle-joint: sometimes of considerable size. It passes obliquely outwards, furnishes branches to the tarsus, to the outer side of ankle-joint, and to the muscles and skin on the upper and outer part of foot; with some, which pass along the outer side of the foot to the little toe: and it forms communications with branches of the fibular, malleolar, and plantar arteries.

5. **Metatarsal** (A. metatarsea). Arises from the outer side of the artery, but varies somewhat as to origin. It is directed obliquely outwards under the extensor brevis digitorum, and forms several communications on the outer side of the foot with the tarsal and other branches of the foot. In its course it sends off,

a. Interosseal branches (A. interosseæ dorsales). Generally four in number, which pass forwards in all the interspaces of the metatarsal bones, except the first; giving off branches to the interossei muscles, and then continued each by two branches upon the lesser toes (A. digitales dorsales).

6. **Branches** which are distributed to the upper and inner part of the foot.

7. **Dorsal of the Great Toe** (A. dorsalis pollicis). One of the two into which the artery divides in the space between the metatarsal bones of the first and second toes. It passes forwards to the great toe, and sends a branch to the second.

8. **Deep Anastomotic Branch** (R. anastomoticus profundus). The other division passes between the first and second metatarsal bone to the sole of the foot, and joins with the plantar arch.

After the origin of the anterior tibial, the posterior tibial descends, covered by the gastrocnemii, for about an inch, and divides into one branch, which retains the name of the common trunk and into the peroneal artery.

PERONEAL ARTERY.

The Peroneal Artery (A. peronea fibularis). Compared with the posterior tibial, it is commonly the less of the two, but varies in size. It sometimes arises higher, and not unfrequently lower; and in some instances is wanting altogether. It takes its course down the leg along the inner side of the fibula, between the superficial and deep layer of muscles, situated at first upon the tibialis posticus, then at the edge of the flexor longus pollicis below; becomes covered by the last named muscle, and terminates by dividing into an anterior and posterior branch. It sends off

1. Muscular Branches. Distributed to the gastrocnemii, tibialis posticus, and flexor longus pollicis, muscles.

2. Branch to the Fibula. Forming a medullary artery.

3. Anterior (A. peronea anterior). Varies in size, passes through the lower part of the interosseous ligament, and is continued before the outer malleolus upon the foot, dividing into branches, distributed to the adjacent muscles, and anastomosing with branches of the anterior tibial artery. It is sometimes a branch of the posterior tibial, and sometimes is altogether wanting: occasionally it is a branch of large size, and forms the artery of the foot, in which case the anterior tibial is unusually small, and terminates by joining with it.

4. Posterior (A. peronea posterior). Descends behind the outer malleolus, distributing branches to the adjacent parts, and terminates on the outer side of the foot, forming anastomoses with the malleolar and tarsal branches of the anterior tibial artery. In some rare instances this branch is of large size, and instead of passing behind the outer ankle bends inwards to the hollow of the os calcis, and divides into the inner and outer plantar arteries.

POSTERIOR TIBIAL ARTERY.

The Posterior Tibial Artery (A. tibialis postica) is larger than the former. It bends inwards after its origin, and descends through the leg behind the tibia, between the superficial and deep layer of muscles; and after passing behind the inner malleolus, terminates at the hollow of the os calcis by dividing into the inner and outer plantar arteries. In its course it is deep-seated above, and passes over the tibialis posticus and flexor longus digitorum muscles, covered by the soleus. At the lower part of the leg it is more superficial, situated between the edge of the tendo Achillis and malleolus internus; it has at that part the tendons of the tibialis posticus and flexor longus digitorum muscles on the inner side, and the tendon of the flexor longus pollicis on the outer side, and is covered by a strong aponeurosis. The tibial nerve is situated at its outer and back part, and the accompanying veins at the sides. It gives off—

1. Branches to the Muscles, and principally to the deep-seated. They are given off during the course of the artery through the leg; but are not considerable either in number or size.

2. Nutritious of the Tibia (A. nutritia tibiæ). A branch of considerable size given off from the upper part of the artery. It descends, and after giving twigs to the periosteum enters the foramen at the back part of the tibia.

3. Branches, two or three in number distributed to parts about the inner ankle, heel, and to the muscles of the great toe, which form several communications with branches of the anterior tibial artery.

PLANTAR ARTERIES.

1. Inner Plantar (A. plantaris interna). Is the smaller of the two. It passes forwards on the inner side of the sole of the foot. It takes its course first under the tendon of the flexor longus digitorum, then upon the adductor pollicis between it and the aponeurosis plantaris. It furnishes

Branches to the muscles of the great toe in the inner plantar region, to the tarsal joints, and branches of communication with branches of the anterior tibial.

The trunk then generally bends inwards, and between the first and second toe joins with the plantar digital branch of the great toe.

2. Outer Plantar (A. plantaris externa). Is larger and more deep-seated than the former. It takes its course obliquely outwards between the flexor brevis and flexor accessorum digitorum to the outer side of the foot. Near the base of the metatarsal bone of the least toe it bends inwards, and is continued as far as the metatarsal bone of the great toe, where it

anastomoses with the deep branch of the anterior tibial, forming the plantar arch (arcus plantaris). It furnishes

Branches to the muscles of the middle and plantar regions, and forms anastomoses on the outer side of the foot with branches of the anterior tibial and peroneal arteries.

3. FROM THE PLANTAR ARCH:—

α. *Branch* to the least toe (A. digitalis plantaris digiti quinti), which passes along its outer side, as far as its extremity, distributing inconsiderable branches in its course.

β. *Plantar Digital Branches* (A. digitales plantares). Generally three in number, which come off from the fore part of the arch, pass forwards to the interstices of the toes (namely, to those of the second and third, third and fourth, and fourth and fifth), and divide each into two branches, one of which passes along the outer side of one toe, and the other along the inner side of the adjacent toe. They are continued as far as their extremities, where they anastomose, furnishing small branches in their course, partly distributed to the toes, and partly communicating with the dorsal branches.

γ. *Plantar digital branches* of the great toe, and inner side of the toe next to it, present very frequent varieties. Most commonly they come off by a branch detached from the deep branch of the anterior tibial, where it joins with the plantar arch, which then sends one branch along the inner side of the great toe, and one to the interstice between the great toe and toe next to it, and divides into a branch to each. Sometimes they are supplied by the inner plantar, and sometimes entirely by the plantar arch.

δ. *Perforating* (A. perforantes). Small branches from the fore and upper part of the arch to the interossei and transverse muscles, and metatarsus, which send branches between the metatarsal bones to anastomose with branches of the anterior tibial on the dorsum of the foot.

§ 6. TABLE OF THE ARTERIES.

1. FROM THE ARCH OF THE AORTA.

1. The un-named trunk, dividing into—
    Right common carotid.
    Right subclavian.
2. Left common carotid.
3. Left subclavian.

The common carotid divides into—*a.* EXTERNAL CAROTID. *b.* INTERNAL CAROTID.

a. EXTERNAL CAROTID. Its branches are:

1. SUPERIOR THYROIDEAL, giving off—
    - α. Muscular branches.
    - β. Laryngeal.
    - γ. Thyroid.

2. LINGUAL, giving off—
    - α. Muscular branches.
    - β. Hyoideal.
    - γ. Dorsal of the tongue.
    - δ. Sublingual.
    - ε. Ranine.

3. FACIAL, giving off—
    - α. Inferior palatine.
    - β. Glandular.
    - γ. Submental.
    - δ. Branches to lips, cheek, &c.
    - ε. Inferior coronary.
    - ζ. Superior coronary.
    - η. Branches to nose, corner of the forehead, &c.

4. ASCENDING PHARYNGEAL.

5. OCCIPITAL, giving off—
    - α. Branches to muscles and glands about angle of jaw.
    - β. Descending branch.
    - γ. Branch to dura mater.
    - δ. Branches to the exterior of the cranium.

6. POSTERIOR AURAL, giving off—
    - α. Branches to parotid gland and muscles.
    - β. Stylo-mastoid.
    - γ. Branches to ear and side of head.

7. TEMPORAL, giving off—
    - α. Branches to parotid gland.
    - β. Branches to the masseter muscle.
    - γ. Transverse of the face.
    - δ. Deep temporal.
    - ε. Anterior auricular.
    - ζ. Temporo-frontal.
    - η. Temporo-occipital.

8. INTERNAL MAXILLARY, giving off—
    - α. Spheno-Spinal.
    - β. Inferior maxillary.
    - γ. Temporal.
    - δ. Masseterine.
    - ε. Buccal.
    - ζ. Pterygoideal.
    - η. Alveolar.
    - θ. Infra-orbitar.
    - ι. Descending palatine.
    - κ. Lateral nasal.

b. INTERNAL CAROTID. Its branches are:

1. OPTHALMIC, giving off—
    - α. Lachrymal.
    - β. Central of the retina.
    - γ. Ciliary.
    - δ. Muscular.
    - ε. Ethmoidal.
    - ζ. Supra-orbitar.
    - η. Internal-angular.

2. COMMUNICATING (with the basilary).

3. ANTERIOR OF CEREBRUM, giving off—
    - Transverse.
    - Artery of corpus callosum.

4. MIDDLE OF CEREBRUM.

5. TO CHOROID PLEXUS.

SUBCLAVIAN ARTERY. Its branches are:

1. VERTEBRAL; giving off—
    - α. Branches to muscles and spinal marrow.
    - β. Posterior artery of the spinal marrow.
    - γ. Inferior artery of the cerebellum.
    - δ. Anterior artery of the spinal marrow.

The vertebral arteries unite to form the

BASILAR ARTERY; giving off—
- α. Branches to pons varolii, &c.
- β. Internal auditory.
- γ. Superior artery of the cerebellum.
- δ. Posterior artery of the cerebrum.

The other branches of the Subclavian artery are:

2. Inferior thyroideal.
3. Supra-scapular.
4. Ascending cervical.
5. Superficial cervical.
6. Deep cervical.
7. Internal mammary, giving off—
    - α. Thymic.
    - β. Pericardiac.
    - γ. Mediastinal.
    - δ. Branch accompanying phrenic nerve.
    - ε. Intercostal.
    - ζ. Phrenic.
    - η. Epigastric.
8. Superior intercostal.

AXILLARY ARTERY; its branches are:

1. Superior thoracic.
2. Humeral thoracic.
3. Long thoracic.
4. Alar thoracic.
5. Infra scapular, giving off—
    - α. Internal scapular.
    - β. Inferior dorsal of the scapula.
6. Anterior circumflex.
7. Posterior circumflex.

BRACHIAL ARTERY; its branches are:

1. Deep humeral, giving off—
    - α. Communicating radial.
    - β. Branches to triceps.
2. Inferior deep humeral.
3. Muscular branches.
4. Anastomotic branch.

RADIAL ARTERY; its branches are:

1. Recurrent radial.
2. Muscular branches.
3. Superficial palmar.

4. Branches to the wrist.
5. Dorsal.
6. Large artery of the thumb.
7. Radial of the fore finger.
8. Deep palmar, which forms the deep palmar arch.

ULNAR ARTERY; its branches are:

1. Recurrent ulnar.
2. Interosseal, giving off—
    - α. Posterior interosseal.
    - β. Anterior interosseal.
3. Muscular branches.
4. Dorsal.
5. Deep ulnar.

It then forms the superficial palmar arch, which gives off the:

6. Digital branches, consisting of:
    - α. Branch to the inner side of the little finger.
    - β. Branch to interstice of ring and little finger.
    - γ. Branch to interstice of ring and middle finger.
    - δ. Branch to interstice of middle and fore finger.

II. BRANCHES FROM THE THORACIC PORTION OF THE AORTA DESCENDENS:

1. Bronchial.
2. Œsophageal.
3. Mediastinal.
4. Intercostal, eight or nine pair.

III. BRANCHES FROM THE ABDOMINAL PORTION OF THE AORTA DESCENDENS:

I. CŒLIAC; divides into:

1. CORONARY OF THE STOMACH.
2. HEPATIC; its branches are:
    1. Right inferior gastric, giving off—
        - α. Duodenal.
        - β. Pancreatic.
        - γ. Epiploic.
        - δ. Gastric.

- 2. Pyloric.
- 3. Right hepatic, giving off—
  - α. Cystic.
- 4. Left hepatic.

3. SPLENIC; its branches are:

- α. Pancreatic.
- β. Short gastric.
- γ. Left inferior gastric.
- δ. Splenic.

2. SUPERIOR MESENTERIC; its branches are:

- 1. Branches from its convexity to small intestines.
- 2. Ilio-colic.
- 3. Right colic.
- 4. Middle colic.

3. INFERIOR MESENTERIC; its branches are:

- 1. Left superior colic.
- 2. Left inferior colic.
- 3. Internal hæmorrhoidal.

- 1. DIAPHRAGMATIC.
- 2. RENAL.
- 3. SPERMATIC.
- 4. LUMBAR (four pair).

4. BRANCHES FROM THE TERMINATION OF THE AORTA:

- 1. MIDDLE SACRAL.
- 2. COMMON ILIAC, divides into—
  - External iliac.
  - Internal iliac.

INTERNAL ILIAC; its branches are:

- 1. Ilio-lumbar.
- 2. Lateral sacral.
- 3. Obturator.
- 4. Gluteal, divides into—
  - α. Superficial branch.
  - β. Deep branch.

5. Ischiadic.
6. Pudic, giving off—
    - α. Branches to parts about the neck of the bladder.
    - β. Branches to parts about the outlet of the pelvis.
    - γ. External hæmorrhoidal.
    - δ. Perineal.
    - ε. Artery of the bulb.
    - ζ. Superficial of the penis.
    - η. Deep of the penis.
7. Umbilical.
8. Vesical.
9. Middle hæmorrhoidal.
10. Vaginal.
11. Uterine.

External Iliac Artery; its branches are:

1. Epigastric, giving off—
    - α. Branch to spermatic cord, or round ligament.
2. Circumflex of the ilium.

Femoral Artery; its branches are:

1. External epigastric.
2. External pudic.
3. Deep artery of the thigh; giving off—
    - α. Internal circumflex.
    - β. External circumflex.
    - γ. Perforating { First perforant. Second perforant.
4. Muscular branches.
5. Anastomotic branch.

Popliteal Artery; its branches are:

1. Branches to flexor muscles of the leg.
2. Superior outer articular.
3. Superior inner articular.
4. Middle articular.
5. Inferior outer articular.
6. Inferior inner articular.

7. Surales.
8. Small branches.

ANTERIOR TIBIAL ARTERY; its branches are:

1. Anterior recurrent.
2. Muscular.
3. Malleolar.
4. Tarsal.
5. Metatarsal, giving off—

    α. Interosseal.

6. Dorsal of the great toe.
7. Deep anastomotic.

PERONEAL ARTERY; its branches are:

1. Muscular.
2. Medullary of the fibula.
3. Anterior.
4. Posterior.

POSTERIOR TIBIAL ARTERY; its branches are:

1. Muscular.
2. Nutritious of the tibia.
3. Branches to ankle, heel, &c.

INNER PLANTAR ARTERY; its branches are—

To the muscles of the great toe and tarsal-joint.

OUTER PLANTAR ARTERY: its branches are:

1. Muscular.

It forms the PLANTAR ARCH, which gives off—

1. Branch to the little toe.
2. Digital branches, consisting of—

    α. Branch to the interstice of the 4th and 5th toe.
    β. Branch to the interstice of the 3rd and 4th toe.
    γ. Branch to the interstice of the 3rd and 2nd toe.

3. Plantar digital branches of the great and 2nd toe.
4. Perforating.

CHAPTER III.

Of the Veins.

In the following account of the distribution of the veins, these vessels are described like the arteries, from trunk to branch, therefore contrary to the course of the blood which flows through them. By so doing, the description is rendered more simple; for as the greater number of veins accompany the arteries, it will be only necessary to refer to the particulars of the course of the corresponding arteries in order to explain the distribution of the accompanying veins. There are, however, some veins which do not take the course of the corresponding arteries, and there are others to which there are no corresponding arteries; it will be therefore requisite to particularise the course and distribution of these two sets of vessels.

The vena portæ and its branches, and the vessels which return the blood from the brain, have been described in the account of the viscera, to which they belong.

Of the seven primitive veins usually described, those namely which pour their contents immediately into the heart—vena cava superior, vena cava inferior, coronary vein, and the four pulmonary veins, the pulmonary and coronary veins have been treated of with the lungs and heart. The veins, therefore, the course and distribution of which remain to be spoken of, and which furnish the branches which accompany, and return the blood from, the ramifications of the aortic system, are the vena cava superior, and inferior.

§ 1. SUPERIOR CAVA.

The Superior Cava (vena cava superior) furnishes the branches which supply the head, neck, upper extremity, and parietes of the chest. It arises from the upper and right part of the right auricle, ascends as high as the cartilage of the first rib, and a little above the curvature of the aorta divides into two considerable trunks, called the subclavian veins. In its course it is surrounded for about two inches by the pericardium: it has *to the left* the aorta, *to the right*, the right lung; *behind*, the right superior pulmonary vein; and *before*, the cartilages of the uppermost ribs.

Occasionally the subclavian veins do not unite, but pass separately to the auricle. In this case the left takes its course downwards before the aorta, passes round the outer and back part of the left auricle, and being continued in the fossa at the under surface of the heart terminates behind and below in the right auricle.

After the vena cava superior has quitted the pericardium, it gives off the—

1. AZYGOUS VEIN (vena azygos, sine pari). It bends backward, between the œsophagus and pleura, to the vertebral column, along which, and situated on the fore part the vertebræ and to the right of the aorta, it descends through the chest. It passes then from that artery, either through the aperture for the aorta or through the lesser muscle of the diaphragm, upon the first lumbar vertebra, and terminates by anastomosing with the inferior cava, with the first lumbar or with the renal veins. It gives off the:

α. *Right bronchial vein* (V. bronchialis dextra), which comes off near the origin of the azygous, and accompanies the bronchia on the same side.

β. *Œsophageal* (V. œsophageæ), small branches to the œsophagus.

γ. *Right inferior intercostal* (V. intercostales inferiores dextræ). They come off from the right and back part of the azygous at various angles, and accompany the intercostal arteries. They are ten or eleven in number; but frequently two or more are furnished by a single trunk.

δ. *Left azygous* (V. azygos sinistra, hemiazygos). Comes off about the seventh or eighth dorsal vertebra. It descends inclined to the left behind the aorta, upon the vertebræ, quits the chest with the aorta, or passes through the appendix of the diaphragm, and terminates, like the azygous vein, on the right side. It sends off in its course the five or six inferior intercostal veins on the left side.

This is the ordinary distribution of this vein, but it is subject to considerable varieties.

SUBCLAVIAN VEINS (V. subclaviæ). These veins, after their origin from the cava, pass obliquely upwards and outwards, quit the chest, above the first rib bend outwards, and are continued before the scaleni antici muscles, which separate them from the corresponding arteries. Having passed the clavicle, they change their name to that of the axillary veins. In consequence of the situation of the superior cava to the right, these veins, between their origin and the scaleni, differ considerably on the right and left sides. The left is nearly twice the length of the right: its direction is nearly horizontal, or but slightly oblique: it takes its course immediately before and above the arch of the aorta, and behind the upper edge of the sternum. The right, on the other hand, has nearly a vertical direction. Both are placed to the outer side of the sternum, behind the cartilage of the first rib, the sternal extremity of the clavicle, and the muscles attached to these parts. The branches which the subclavian veins furnish are the—1. Superior intercostal—2. Internal mammary—3. Inferior thyroideal—4. Vertebral—5. External jugular—6. Internal jugular; and some branches of less importance to the diaphragm, the thymus gland, and the pericardium.

1. SUPERIOR INTERCOSTAL (V. intercostalis suprema). From the lower and back part of the subclavian. The right divides into branches to the two uppermost intercostal spaces. The left is considerably larger than the right, and is sometimes a branch of the vertebral; it divides into branches which accompany the intercostal arteries on the left side as far as the seventh or eighth intercostal space, and anastomoses with branches of the azygous vein. It gives off also the

α. *Left bronchial vein,* which is distributed like the right.

2. INTERNAL MAMMARY (V. mammaria interna). It accompanies, and corresponds with the artery of the same name.

3. INFERIOR THYROIDEAL (V. thyroidea inferior). The right arises nearer to the extremity of the subclavian on the same side, than the left, and sometimes takes its origin from the superior cava itself. It passes upwards and inwards, and divides into branches which form anastomoses with branches of the opposite vein, and are distributed to the thyroid gland, and adjacent parts. The ramification of these branches about the trachea has been called the thyroideal plexus.

4. VERTEBRAL (Vena vertebralis). Arises from the back part of the subclavian. It passes obliquely upward and backward, takes its course to the foramen in the transverse process of the sixth cervical vertebra, and is continued with the vertebral artery, before which it is placed, through the transverse processes of the vertebræ above. It usually gives off a branch below, which

sometimes arises separately, passes through the transverse process of the seventh cervical vertebra, and joins with the trunk. The vertebral vein in its course gives off branches which pass between the muscles and other branches, that communicate through the vertebral foramina with the vertebral sinus. It terminates by branches to the muscles under the occiput, and sometimes one branch passes through the posterior condyloid foramen to communicate with the lateral sinus.

5. EXTERNAL JUGULAR (V. jugularis externa). It arises on the outer side of the internal jugular, sometimes by two branches which soon unite. It passes upward from behind the clavicle behind the sterno-mastoid muscle, embedded in cellular membrane towards the edge of that muscle. It passes then upon the sterno-mastoid, becoming more superficial, and covered only by the platysma myoides and skin. It crosses then obliquely the upper part of the muscle, and is continued to the angle of the lower jaw. It sometimes terminates here by an anastomotic branch with the internal jugular vein; but sometimes it is of large size, and accompanies the external carotid artery through the parotid gland, and near the neck of the lower jaw divides into the internal maxillary and temporal veins. These veins again divide, and are distributed like the arteries of the same name. It gives off

α. *Branches* behind the sterno-mastoid, which accompany the scapular and posterior cervical branches of the subclavian artery.

β. *Sub-cutaneous branches* to the neck.

γ. *Posterior aural vein;* which is distributed with the artery of the same name.

δ. *Anastomotic branch.* A short but considerable branch, which passes deep under the parotid gland, and forms a communication with the internal jugular vein.

6. INTERNAL JUGULAR (V. jugularis interna). Is a vein of considerable size. It furnishes most of the branches of the cranium and face. It comes off from the subclavian vein, nearly opposite to the extremity of the clavicle; then ascends nearly vertically in the neck, as high as the lacerated foramen of the base of the skull. In its course it is situated to the outer side of the carotid artery, which it in part covers, and likewise the pneumo-gastric nerve. It has otherwise the same relative position as the carotid. At the lower part of the neck it forms a considerable sinus or enlargement.

At the upper part of the larynx it gives off the SUPERIOR THYROIDEAL, the FACIAL, the LINGUAL, the PHARYNGEAL and OCCIPITAL veins. These veins take the course of the corresponding arteries, and are distributed in the same way with little variety.

At the lacerated openings of the base of the skull, the internal jugular vein receives the lateral sinus on each side, so that it returns the blood which has circulated through the brain, and of which the lateral sinuses are reservoirs from the other sinuses and returning vessels of the brain. For their description see p. 75.

AXILLARY VEIN (V. axillaris).

It furnishes the veins which are distributed to the upper extremity. These are divided into—1. Superficial, 2. Deep-seated. The deep-seated takes the course of the arteries of the same name, and the greater number of the arteries are accompanied each by two veins. The axillary vein receives that name after having passed the clavicle. It passes obliquely downwards and outwards in the axilla, situated *before* the corresponding artery, but having otherwise the same relative position. Having reached the lower edge of the tendon of the latissimus dorsi, it changes its name to that of brachial vein.

It gives off in its course the EXTERNAL THORACIC, INFRA SCAPULAR, and ARTICULAR VEINS, which are distributed like the arteries of the same name. Besides these it furnishes two considerable veins, which form the superficial or cutaneous veins of the upper extremity, viz. the cephalic and basilic.

1. CEPHALIC (V. cephalica). It arises from the axillary, immediately after it has passed the clavicle. It takes its course outward, between the large pectoral and deltoid muscles, then descends between these muscles, and is continued upon the fore and outer part of the upper arm, along the outer side of the biceps flexor cubiti, as far as the bend of the elbow, giving off in its course some small branches. At the bend of the elbow it divides into two branches, the cephalic median and superficial radial.

α. *Cephalic median* (V. mediana cephalica). Generally of considerable size, which passes obliquely downwards and inwards, and joins below with the basilic median vein.

β. *Superficial radial* (V. radialis cutanea). Which descends on the outer part of the fore arm. It commonly divides into two branches, one of which takes its course more on the fore part of the arm, and sometimes into several branches. These furnish numerous branches which are continued obliquely to the back of the hand, and contribute to form there a considerable plexus. One of the principal branches is found in the space between the metacarpal bones of the thumb and fore finger, and is frequently distinguished by the name of the cephalic of the thumb (V. cephalica pollicis).

2. BASILIC (V. basilica). Larger than the cephalic. It arises from the axillary vein, usually just before it becomes brachial, and is at this part deep-seated. It descends on the inner side of the arm in the course of the ulnar nerve, which it conceals, and gives off a few branches only. A little above the inner condyle of the os humeri it divides into two branches, the basilic median and superficial ulnar.

α. *Basilic median* (V. mediana basilica). Descends obliquely outwards, and unites at an acute angle commonly with the cephalic median. From this junction arise usually two branches, a deep branch and the common median.

β. The *deep* branch passes deep-seated between the muscles, forming an anastomosis with the deep-seated veins.

γ. *Common median* (V. mediana communis). It passes down on the anterior surface of the fore arm, is continued obliquely outwards, and divides into branches, the greater number of which pass round the radius to join with the superficial radial veins. The branches of this vein sometimes supply the place of the superficial radial.

δ. *Superficial ulnar* (V. ulnaris superficialis cutanea). It commonly divides into two branches, an anterior and a posterior, the latter of which is the more considerable. They descend on the inner side of the fore arm, are inclined towards the back of the hand, and divide into numerous branches which freely communicate with the branches of the superficial radial, and assist them in forming a considerable plexus. One branch which is placed between the ring finger and little finger has been distinguished by the name of salvatella.

BRACHIAL VEIN (Vena brachialis).

It is frequently double, or, if single, divides in its course into two branches, which accompany the brachial artery during the rest of its course. Where the artery divides, each of the veins gives off two branches, which take the course of the radial and ulnar arteries, and furnish branches that accompany the divisions of those vessels, so that each branch of an artery is accompanied by two veins.

§ 2. INFERIOR CAVA (VENA CAVA INFERIOR).

The inferior cava furnishes the ramifications which accompany the distribution of the aortic system in the lower part of the trunk and lower extremities. This vein is of larger size than the superior cava; it arises from the outer and back of the right auricle, and extends then from that part to the fourth or fifth lumbar vertebra. After its origin, it is directed a little outwards, and passes through the aperture in the tendon of the diaphragm; this takes place so immediately after its origin, that the pericardium is attached only to a very small portion of the vessel. Having entered the abdomen, it continues its course, forming a slight bend to the right, deep-seated in the depression and sometimes in a complete canal, at the posterior edge of the liver. Below the liver, it descends upon the right side of the bodies of lumbar vertebræ, situated to the right of the aorta, and at the fourth or fifth vertebra terminates, by dividing into the two common iliac veins. The inferior cava sometimes divides into two branches, which again unite; the additional vessel however varying in size and length. The branches which the inferior cava gives off during its course are:—the DIAPHRAGMATIC, HEPATIC, RENAL, CAPSULAR, SPERMATIC, and LUMBAR.—These accompany the arteries of the same name, and are distributed like them. The left renal vein, however, is longer than the right, and commonly passes before the aorta to its destination. The left lumbar veins also, which pass behind the aorta, are longer than the right. The left spermatic vein comes off from the left renal vein.

HEPATIC VEINS. Usually consist of two or three large, and numerous small, veins; the former coming off from the cava opposite to the convex surface of the liver, so soon as that vein has entered the abdomen, and the latter behind the liver. They pass into and ramify within the substance of the lobes of the liver.

MIDDLE SACRAL vein. Comes off from the extremity of the inferior cava, and frequently from the left common iliac vein. It accompanies the artery of the same name.

COMMON ILIAC VEIN (Vena iliaca communis, primitiva). It passes downward and outward, forming with the opposite vein an obtuse angle, and about opposite to the sacro-iliac symphysis divides into external and internal iliac vein. In consequence of the cava dividing below and to the right of the aorta, the right common iliac artery crosses before the left common iliac vein. The common iliac veins are situated behind and a little to the inner side of the arteries which they accompany.

INTERNAL ILIAC VEIN (V. iliaca interna, hypogastrica). It descends into the pelvis, behind the artery which it accompanies. Its branches are of considerable size, and correspond in number, name, and distribution, with the branches of the internal iliac artery. Their ramifications within the pelvis are very considerable, and form a sort of plexus surrounding each of the viscera, as the bladder inferiorly, the rectum, and the vagina in the female.

EXTERNAL ILIAC VEIN (V. iliaca externa). It accompanies the artery of the same name, and is situated behind and to the inner side of that vessel. It passes with it under Poupart's ligament, and there changes its name to that of the femoral vein. It gives off the epigastric and circumflex iliac veins, which are distributed with the corresponding arteries.

FEMORAL VEIN (V. femoralis). It supplies the lower extremity with a deep-seated and superficial set of veins, like those already described in the upper extremity. The femoral vein descends through the thigh with the femoral artery; it is situated at Poupart's ligament, and in the upper part of the thigh to the inner side of the artery, but in its course is gradually inclined behind that vessel. It passes with it through the tendon of the adductor magnus, and on entering the ham takes the name of the popliteal vein. In its course the femoral gives off branches, which accompany the deep artery of the thigh and its ramifications, and the other branches of the femoral artery. It furnishes besides a considerable subcutaneous branch: the

SAPHÆNA (V. saphæna major). It arises from the femoral, a little below Poupart's ligament, and passes through the opening of the fascia of the thigh. It descends then between the aponeurosis and skin along the inner side of the thigh; detaching some branches to the parts of generation, some which ascend between the skin and muscles of the abdomen, and a branch which passes down a little before it and distributes branches to the fore part of the thigh; this branch anastomoses with the saphæna near the inner condyle, or is continued sometimes down the leg. The saphæna is continued from the thigh behind the inner condyle, takes its course obliquely along the inner and fore part of the leg, passes then before the inner malleolus upon the dorsum of the foot, and spreads into branches, which reach as far as the toes, and form, by anastomosing, an intricate plexus.

POPLITEAL VEIN (V. poplitea). Descends behind the popliteal artery, and after furnishing branches which accompany the divisions of that artery, divides into ANTERIOR and POSTERIOR TIBIAL VEINS: and, as in the upper extremity, each artery is accompanied by two veins, which accompany, and are distributed like, the corresponding arteries. It gives off also the second subcutaneous branch: the

LESSER SAPHÆNA (V. Saphæna minor). Arises in the hollow of the ham. It descends nearly vertically with the tibial nerve; soon, however, quits the nerve, and descends between the gastrocnemius and skin, in the depression between the heads of that muscle; then continues its course along the edge of the tendo Achillis, passes behind the outer malleolus, and divides into numerous branches, which extend along the upper and outer part of the foot, and anastomose with branches of the saphæna major.

CHAPTER IV.

Of the Absorbents.

THE absorbent system consists of *glands* and *vessels*. In the following description we have adopted the method of first describing the glands, and afterwards the distribution of the vessels in the different divisions of the body. The absorbent vessels accompany for the most part the ramifications of the blood-vessels, especially those of the veins; and, therefore, a reference to these will in most instances indicate the distribution of the former. From the number of absorbent vessels, it would be both difficult and unprofitable to trace them singly, and they will, therefore, be described in sets. The main trunks and termination of the absorbents, formed by the thoracic duct and the trunk of termination on the right side, will be first spoken of; and afterwards, the glands and vessels of the head and neck, of the upper extremity, of the lower extremity, and of the trunk and viscera, will be successively described. The absorbent vessels take their course in almost all parts of the body, in a *superficial* and more numerous set, and in a *deep-seated* set, accompanying the arteries.

We have not adopted the division of the absorbents into lacteal and lymphatic vessels, as the distinction seems to have no real foundation nor practical utility.

§ 1. TRUNKS OF THE ABSORBENT VESSELS.

All the absorbent vessels of the body terminate in two trunks, which pour their contents into the venous system at two points; namely, at the junction of the internal jugular and subclavian veins on each side. By far the greater number terminate in the trunk on the left side, called the thoracic duct. It receives the absorbents of the left half of the head and neck, of the left upper extremity, of both lower extremities, of the left half of the chest and its contents, and of the viscera of the abdomen, except some from the liver. Therefore, those which terminate in the trunk on the right side, are those only of the right half of the head and eck [redacted], of the right upper extremity, of the right half of the parietes and contents of the thorax, and of a part of the liver.

1. Left Trunk (Ductus thoracicus sinister). Begins between the crura of the diaphragm, upon the first or second lumbar vertebra, or sometimes as high as the twelfth dorsal vertebra, being formed by the junction of the absorbents of the lower extremities and of those of the abdominal viscera. The latter sometimes terminate by several trunks; but it is formed, in most instances, by three trunks, of which the middle trunk receives the absorbents from the viscera, and the two others those of the lower extremities. Near, or at the part where these trunks unite, is formed the receptacle of the chyle (receptaculum, cysterna chyli). In many instances, this is truly an enlargement of the under extremity of the duct of an oval or pyriform figure; but frequently the appearance is found to be produced by the conglomeration of the numerous tortuous absorbent trunks, forming the thoracic duct, and intimately connected and covered by a dense cellular structure. The thoracic duct then passes behind and to the right of the aorta, between the crura of the diaphragm into the chest. It is at first placed upon the fore and right side of the vertebræ, and takes its course upward, between the aorta and vena azygos. In its ascent it bends over to the left side, commonly about the fourth or fifth dorsal vertebra, behind the œsophagus, and continues its course behind the arch of the aorta, and through the upper opening of the chest, as high as the upper edge of the last cervical vertebra. It then makes a turn downwards and inwards, and terminates in the upper and back part of the angle formed by the left internal jugular and left subclavian vein, or occasionally in one only of these veins.

About the middle of the chest it is usually somewhat contracted, but enlarges again superiorly. It is commonly more or less tortuous in its course, and most frequently divides into two or more collateral branches, which again unite, or sometimes terminate separately. Occasionally it is found to divide into two branches, about the middle of the chest, one of which only terminates on the left, whilst the other passes to the right side of the neck.

2. Right Trunk (Ductus thoracicus dexter).—It is much smaller than the left, and is seldom more than half an inch in length. It is formed by the absorbent vessels of the upper and right part of the body, as has been already mentioned; and terminates in the angle formed by the right internal jugular

and right subclavian vein, in some instances in one only of these vessels. Occasionally it is found wanting, in which case the absorbent trunks which otherwise form it, enter the veins separately at that part.

§ 2. ABSORBENT GLANDS AND VESSELS OF THE HEAD AND NECK.

1. Glands of the Head and Neck.

α. Glands of the Head. Their number and size are inconsiderable. Their existence in the interior of the cranium has not been clearly ascertained. They are distinct on the external surface of the head, but are more numerous on the face than on the cranium.—α. On the cranium, there are two or three small glands placed behind the ear.—β. On the face: there are more numerous glands, situated, some superficially upon the parotid gland, some deep-seated upon the buccinator muscle, and some behind the parotid gland. Those most constantly found, are glands situated along the under edge of the lower jaw upon the anterior belly of the digastricus muscle.

β. Glands of the Neck. There are some few of small size but not always distinct, which are placed superficially in the course of the external jugular vein. The deeper seated glands are more considerable, both in size and number; there are one or two near the larynx, and some few at the back part of the neck, but the most considerable are situated at the sides of the neck, (Glandulæ concatenatæ, jugulares) and are more numerous than any other set of glands in the body, excepting those of the mesentery. They form a chain in the course of the carotid artery and the internal jugular vein, covered by the sterno-mastoid muscle, from the mastoid process to the upper part of the chest. They are most numerous near the division of the trunks of the blood-vessels. There are also smaller glands situated in the space between the sterno-mastoid and trapezius muscle and the clavicle.

2. Absorbent Vessels of the Head and Neck.

1. Superficial Absorbents of the Head.

α. Superficial Absorbents of the Cranium. Unite to form an uncertain number of trunks. The anterior, three or four in number, accompany the temporal vessels, and enter some of the glands situated under the zygoma.

The posterior, which are not more numerous, descend in the course of the occipital artery, pass through the small glands behind the ear, and unite with the superficial absorbents of the neck.

β. SUPERFICIAL ABSORBENTS OF THE FACE. Are more numerous than the above; accompany the blood-vessels. Some pass through the glands on the buccinator muscle, but the greater number through the glands at the under edge of the lower jaw, and the glands at the upper part of the neck. And, at this part, the superficial absorbents of the cranium and face join with the deep vessels of the head, and are continued by three or four trunks, which accompany the internal and external jugular veins.

2. DEEP-SEATED OF THE HEAD.

α. DEEP-SEATED OF THE CRANIUM.—They have only been found on the membranes of the brain, but have never been traced into its substance. Their trunks pass out of the cranium with the blood-vessels, and unite with the superficial absorbent vessels of the head and neck.

β. DEEP-SEATED OF THE FACE. Arise from the muscles and cavities of the nose and mouth. Their trunks accompany the blood-vessels, and enter the upper cervical glands.

All the trunks of the superficial and deep-seated absorbents of the head and neck pass through the cervical glands, freely communicate with each other, and with absorbents from the chest and upper extremity. They unite to form one or more trunks, which terminate in the upper part of the thoracic duct, at the angle formed by the internal jugular and subclavian veins, or in one of these veins.

§ 3. ABSORBENT GLANDS AND VESSELS OF THE UPPER EXTREMITY.

1. GLANDS OF THE UPPER EXTREMITY.—There are seldom any found below the elbow-joint.

α. GLANDS AT THE ELBOW. There are commonly two or three small glands anteriorly, near the inner condyle. Between the condyle and the cavity of the axilla five or six glands are commonly found on the inner and fore part of the upper arm, in the course of the humeral artery.

β. AXILLARY GLANDS. The number and size of these are much more considerable than the above-mentioned, being sometimes, as many as twelve in number.

They surround the trunks of the blood-vessels, and are situated principally between the serratus magnus, pectoralis minor, and the trunks of the axillary vessels, to which they closely adhere, but extend under the pectoralis major and clavicle.

2. ABSORBENT VESSELS OF THE UPPER EXTREMITY. The superficial absorbents of the trunk are considered with these, as they all terminate in the axillary glands.

1. SUPERFICIAL ABSORBENTS.

α. OF THE BACK OF THE TRUNK. The superficial absorbents of the whole surface of the back, from the neck to the loins, terminate in the axillary glands. The greater number of these pass upon the trapezius muscle, and are continued through it into the axilla.

β. OF THE SIDE AND FORE PART OF THE TRUNK. The upper pass over the pectoralis major, and bend over its under edge to the axilla. The lower pass over the serratus magnus and obliquus externus abdominis to the axillary glands. Some of these penetrate the parietes of the chest, and join with absorbents in its interior.

γ. OF THE UPPER EXTREMITY. They arise from the fore and back parts of the fingers and hand.—Those of the back part ascend upon the fore arm, forming a considerable and freely communicating plexus: they separate then into two sets; one of which passes obliquely over the muscles on the radius, and the other over those on the ulna, to the fore and inner part of the fore arm, so that near the elbow-joint they all are situated anteriorly. Those of the anterior part of the hand unite, to form three or four trunks, which ascend on the fore arm, and unite near the elbow with the posterior set. Most of the absorbents pass through the glands at the elbow, and on the inner side of the upper arm, unite into fewer trunks, and terminate in the axillary glands. A few of the absorbents accompany the cephalic vein; and, after passing between the deltoid and larger pectoral muscles, terminate also in the axillary glands.

2. DEEP-SEATED ABSORBENTS.

These are much fewer in number. Two commonly accompany each principal artery in the fore arm, and these are united into trunks, which ascend with the brachial artery. They communicate freely with the superficial set, and terminate in the axillary glands.

The above-described absorbent vessels of the upper extremity and surface of the trunk, which pass through the axillary glands, unite to form four or five trunks, which surround the subclavian vein. Where this vessel enters the chest these again unite to form two or three larger trunks, which ascend behind the subclavius muscle, and over the subclavian artery, and terminate either separately or after having joined with the deep-seated absorbents and head, on the right side in the right trunk, and on the left side in the thoracic duct.

§ 4. ABSORBENT GLANDS AND VESSELS OF THE LOWER EXTREMITY.

1. **Glands of the Lower Extremity.** These are rarely found below the knee, one has been, however, occasionally noticed upon the upper end of the interosseous ligament connecting the tibia with the fibula.

α. *Popliteal glands.* Are small in size, and their number rarely exceeds three or four. They are deep-seated in the fat and cellular membrane, which surrounds the popliteal vessels.

β. *Inguinal glands.* These, except the mesenteric, are the largest glands in the body. Some of these are situated superficially, and others deep-seated. They vary in size; and in number from eight to sixteen, but there are generally about twelve. The superficial are placed between the skin and fascia of the thigh, and the greater number of these close together about the termination of the saphæna major, whilst others are situated lower on the fore part of the thigh. The deep-seated are less numerous; they are placed under the fascia, and close to the femoral vessels.

γ. *External iliac glands.* Are six or eight in number. They are placed in the course of the iliac vessels from Poupart's ligaments to the lumbar glands.

δ. *Internal iliac glands.* Vary in number, but are in general more numerous than the external. They are situated about the branches of the internal iliac vessels.

ε. *Sacral Glands.* Are placed between the sacrum and rectum.

2. **Absorbent Vessels of the Lower Extremity.** With these are described as in the upper extremity some of the absorbents of the trunk, and in addition those of the external parts of the organs of generation.

1. Superficial Absorbents.

α. *Of the under part of the trunk.* These arise from the under and fore part of the abdomen, from the loins, buttocks, and perineum. They form communications with each other, and with the superficial absorbents of the lower extremity, and terminate in the inguinal glands.

β. *Of the external parts of the organs of generation.* In the male they arise from the scrotum and penis; in the female from the clitoris and labia. Those of the penis and clitoris take their course along the dorsum and side of these parts in two or three trunks. They form various anastomoses at the upper part of the thigh and terminate in the inguinal glands.

γ. *Of the lower extremity.* They arise by an anterior and posterior set. The anterior set is formed by absorbents which arise from the upper part of the toes and foot, upon which they form a considerable plexus: the branches from these take their course upwards along the fore and inner part of the leg, to the inner part of the knee. The posterior set is formed by vessels which arise principally from the sole of the foot, and ascend on the posterior surface, but most of them during their course pass obliquely over the fore and back part of the leg to join with the anterior set. From the branches of both sets larger trunks are formed, consisting of about twelve or fourteen vessels which ascend on the fore and inner part of the thigh, and terminate at the groin in the superficial inguinal glands. The superficial absorbents of the thigh take the same course, those from the back part passing round to join with the former, and terminate also in the inguinal glands.

2. Deep-seated Absorbents.

They are much less numerous than the former, and accompany the blood-vessels. In the leg one or two trunks are found accompanying each of the arteries, and arising from the parts to which the arteries are distributed. They pass with these to the ham, and there terminate in the popliteal glands. From these glands three or four larger trunks accompany the popliteal and then take the course of the femoral artery, and receiving in their ascent some vessels, which accompany the deep arteries, terminate in the inguinal glands. Some of the deep-seated absorbents of the thigh accompany the ischiatic and obturator arteries and terminate in glands situated in the pelvis.

§ 5. ABSORBENT GLANDS AND VESSELS OF THE ABDOMEN.

1. Glands of the Abdomen. Are more numerous than those of any part of the body. They are situated principally

in the doublings of the peritonæum, and may be divided into the mesenteric, ventricular, cœliac, and lumbar.

α. *Mesenteric.* Are the most considerable both in size and number. Those of the small intestines are larger and more numerous than those belonging to the large intestines, and those corresponding to the jejunum exceed in both respects those of the other small intestines. There are generally about a hundred, but they vary in number, and many more have been sometimes counted. They are situated between the layers of the mesentery, and none nearer than from one to two inches from the intestines; they increase in size, and are placed more closely together towards the root of the mesentery. The glands of the large intestines are rarely more than thirty, and sometimes not more than twenty, in number; the greater number are found between the layers of the transverse meso-colon. They are situated nearer to the intestines than the former.

β. *Ventricular.* Are situated along the greater and lesser curvature of the stomach; but they are of small size and few, seldom exceeding four or five in number.

γ. *Cœliac.* Are the glands situated about the vena portæ and the divisions of the cœliac and superior mesenteric artery. They vary in number.

δ. *Lumbar.* Are large and numerous. They surround the aorta and vena cava, and are situated on the fore part and sides of the lumbar vertebræ.

2. ABSORBENT VESSELS OF THE ABDOMEN.

1. OF THE PARIETES OF THE ABDOMEN. The anterior accompany the epigastric artery, the lateral pass along the crista of the ilium, and both terminate in the external iliac glands. The posterior pass to the lumbar glands; and those of the parietes of the pelvis are continued to the internal and external iliac and to the lumbar glands.

2. OF THE VISCERA OF THE ABDOMEN. They may be divided into those of the *urinary* and *generative* organs, and those of the *chylopoietic viscera.*

1. OF THE URINARY AND GENERATIVE ORGANS. The superficial absorbents have been already described.

α. *Of the kidney.* The superficial arise from the external surface, pass towards the sinus, and after forming several trunks, join with the deep-seated. The deep-seated arise from the interior, take their course with the vessels to the sinus, and together with the superfical terminate in the lumbar glands.

β. *Of the renal capsule.* Unite partly with those of the kidney, and in part with those of the digestive organs at the upper part of the abdomen.

γ. *Of the ureters.* Join with those of the urinary bladder and kidneys, and terminate in the iliac and lumbar glands.

δ. *Of the urinary bladder.* Form a considerable plexus on its parietes; are continued to the internal iliac glands.

ε. *Of the penis and clitoris.* The deep-seated absorbents of the penis and clitoris, pass with the blood-vessels into the pelvis, and terminate in the pelvic glands.

ζ. *Of the testicle.* They are numerous and of large size; they form eight or ten trunks, which pass up in the spermatic cord, follow the course of the spermatic blood-vessels, and terminate in the lumbar glands.

η. *Of the prostate gland and vesiculæ seminales.* They join with those of the bladder.

θ. *Of the vagina and uterus.* Those of the vagina and lower part of the uterus terminate in the iliac glands, except some which arise from the orifice of the vagina, and accompany the round ligament through the abdominal ring. Those of the upper and larger part of the uterus are joined by those of the ovaria, accompany the spermatic vessels, and terminate in the lumbar glands.

2. ABSORBENT VESSELS OF THE CHYLOPOIETIC VISCERA. They are distinguished into those of the intestines, stomach, omenta, liver, spleen, and pancreas. Those of the intestines are frequently called lacteals, from the milk-like fluid which they convey during the digestive process, but do not differ in fact from the absorbents at other parts of the body.

α. *Of the intestines.* Those of the small are much more numerous than those of the large intestines; and of the small those of the duodenum and jejunum are in greater number than those of the ilium. The superficial arise from the peritonæal and muscular coats; they run lengthwise on the intestines, and freely anastomose. The deep-seated arise from the villous coat, and form the orifices which absorb the chyle. They pass transversely on the intestinal canal, which they surround, and anastomose freely with the superficial set. Both sets unite to form trunks, which run between the layers of the mesentery, with the blood-vessels, and pass through the mesenteric glands.

In their course they join into fewer but larger trunks, and near the pancreas unite with the absorbents of that gland, and of the spleen and liver, to form one of the large roots of the thoracic duct. The absorbents of the descending colon and rectum terminate in the lumbar and sacral glands.

β. *Of the stomach and omenta.* In the stomach may be distinguished a superficial and a deep-seated set. They follow the course of the principal blood-vessels of the stomach. Those of the left extremity pass with the short arteries, and join with the absorbents of the spleen. Those of the upper part arise from the upper part of the stomach; they pass to the left along the less curvature, and through the small glands of that part; then unite near the cardia, are continued to the right, and join with absorbent trunks from the liver. Those of the under part are formed by branches from the under part of both the surfaces of the stomach, and from the omentum; they accompany the blood-vessels along the greater curvature of the stomach, and pass through the glands which are found in that situation: they take their course behind the pancreas in the neighbourhood of the cœliac and superior mesenteric arteries, and there join with the trunk of the absorbents of the intestines.

γ. *Of the spleen and pancreas.* The superficial of the spleen arise from its surface, and pass from its convex to its concave surface. The deep-seated arise in its substance, and pass out at the sinus, where they are joined by the superficial. Both sets then accompany the splenic vessels to the right, and join with the other absorbent trunks of the digestive organs.

Those of the pancreas join with the absorbents of the spleen and stomach.

δ. *Of the liver.* The superficial absorbents of the upper surface are distributed into three or more sets, which have each a different course of termination. One set is formed by branches from the middle both of the right and left lobe, and consists of six or seven trunks, which ascend between the layers of the suspensory ligament, and pass into the chest between the diaphragm and ensiform cartilage: they are continued through the anterior mediastinum, receiving in their course absorbents from the diaphragm, pericardium, and thymus gland, and terminate commonly in the left trunk, but sometimes in the right, or both. Some of the absorbents of this set occasionally terminate in the thoracic duct before it has quitted the abdomen. The second set is formed by branches from the right lobe, the trunks, of which it is composed, ascend upon the right lateral ligament, pass through the diaphragm, are continued upon its convex surface near the ribs, and terminate in the trunks of the first set: some branches like those of the former terminate in the thoracic duct. The third set is formed by branches from the left lobe, its trunks pass to the left lateral ligament, join with absorbents from the stomach, and terminate in the thoracic duct before it has quitted the abdomen.

The superficial absorbents of the under surface are less numerous; those of the right and left lobe usually unite to form one set. They all anastomose with the superficial of the upper surface, and with the deep-seated, and form trunks which are collected in the porta, descend with the hepatic vessels, and join with the absorbent trunks of the intestines.

The deep-seated absorbents accompany the blood-vessels and biliary ducts, are collected into trunks which pass out at the porta of the liver, join with the superficial of the under surface of the liver, with those of the stomach, spleen, and pancreas, and unite at the root of the mesentery with the absorbents of the intestines to form the middle root of the thoracic duct.

§ 6. ABSORBENT GLANDS, AND VESSELS OF THE CHEST.

1. Glands of the Chest. They consist of those of the parietes, of the mediastinum, and of the lungs.

α. *Glands of the parietes.* They are small and irregular, both in number and situation. The greater number are placed between the layers of the intercostal muscles, and at the sides of the vertebræ on the heads of the ribs. There are some few in the course of the internal mammary artery.

β. *Glands of the mediastinum.* Those of the posterior mediastinum are small, but often numerous. They are situated in the course of the aorta and œsophagus. Those of the anterior mediastinum are about eight or ten in number, and are situated upon the anterior surface of the pericardium.

γ. *Bronchial glands.* They are situated about the divisions of the bronchia, and are found to extend with their branches into the substance of the lungs. Their size and number are considerable. The largest are placed between the divisions of the trachea. At an early period of life they are of a reddish colour; in the adult they assume a brownish hue, and as age advances become black.

2. Absorbent Vessels of the Chest. They consist of those of the parietes and of the organs contained within the chest.

α. *Of the parietes.* Those of the sides consist of branches from all the parts which form the parietes of the chest. They unite into trunks, which accompany the blood-vessels in the intercostal spaces, and join at the side of the vertebral column with branches from the spinal canal, and from the muscles of the back. They pass through the glands at the side of the spine, and terminate in the thoracic duct. Those of the fore part arise from the upper part of the abdominal muscles and diaphragm, are united into trunks which take their course at the sides of the posterior surface of the sternum, pass through the glands, which are there situated, receive in their course branches from the intercostal spaces, and form one or two trunks which ascend before the left subclavian vein. Those of the right side terminate in the right trunk or separately in the subclavian or jugular vein. Those of the left side terminate in the left trunk.

β. *Of the lungs.* The superficial arise from all parts of their surface, and form a complicated network or plexus upon their lobes. They form trunks which pass to the inner surface, and terminate in the bronchial glands. The deep-seated arise from the substance of the lungs, anastomose freely with the superficial, are united into trunks, which accompany the ramifications of the air-tube and blood-vessels, and terminate in the bronchial glands. The vessels which pass off from the bronchial glands form two or three trunks, which ascend behind the internal jugular vein, and terminate on the right side in the right trunk, and on the left in the left trunk of the absorbents.

The trunks above described receive the absorbents of the pericardium and thymus gland, which ascend in the anterior mediastinum, where they pass through some small glands.

γ. *Of the heart.* The absorbents of the heart accompany its vessels, ascend upon the aorta and pulmonary artery, and pass through several small glands in their course. They unite with the absorbents of the lungs, thymus gland, and anterior mediastinum, and terminate in the left trunk of the absorbents, or separately in the subclavian and jugular vein.

CHAPTER V.

Of the Nerves.

The nerves are divided into three classes:—1. The cerebral nerves, or those which arise from the brain:—2. The spinal nerves, or those which arise from the spinal cord; and 3. The sympathetic nerves. They consist collectively, including the sympathetic, of forty-three pairs. Different anatomists have adopted different modes of enumeration and of classification. These differences have principally arisen from considering as portions of nerves some which have been here numbered as distinct, increasing the number of spinal nerves by those which take their origin from the medulla oblongata, or increasing that of the cerebral nerves by those which are here considered as originating from the spinal cord, or lastly from not distinguishing the sympathetic as a peculiar pair or system of nerves. In the following description we consider the cerebral nerves to consist of eleven pairs, viz.

1. Olfactory.
2. Optic.
3. Common oculo-muscular (motores oculorum communes).
4. Inner oculo-muscular (pathetici).
5. Trigeminal.
6. Outer oculo-muscular (abducentes).
7. Facial.
8. Auditory.
9. Glosso-pharyngeal.
10. Pneumo-gastric (N. vagi).
11. Lingual.

The spinal nerves are described as consisting of thirty-one pairs, viz.

Accessory.
Sub-occipital.
Seven Cervical.
Twelve Dorsal.
Five Lumbar.
Five Sacral.

And lastly the sympathetic, forming one pair, and compleating the number of forty-three pairs of original nerves.

§ 1. CEREBRAL NERVES.

For the origin of these nerves, see the description of the brain, p. 90.

I. Olfactory (N. olfactorius, par primum). It passes forwards, and a little inwards, from the under and back part of the anterior lobes of the cerebrum, in a fossa upon their under surface, to the cribriform plate of the ethmoid bone; and gradually enlarging, here forms an oval bulb. From the under surface of the bulb numerous filaments arise, which pass through the perforations of the cribriform plate. These filaments divide into two sets, one passing on to the septum, the other upon the ossa turbinata; and, continued between the membrane and bone, are distributed to the membrane of the nose.

II. Optic (N. opticus, par secundum). Is the largest of the cerebral nerves. It passes down from the back part of the thalamus, and is continued forwards and inwards over the under surface of the crus cerebri, with which it is connected. It is at first flattened, but becomes in its course gradually rounded; and upon the under surface of the floor of the third ventricle, joins with the opposite nerve. (With respect to the mode of this junction, *see* p. 90.) It then separates from the other optic nerve, and takes its course forward and outward; passes through the foramen opticum, and after penetrating the sclerotic and choroid coats of the eye, spreads out to form the retina.

III. Common Oculo-muscular (N. oculo-muscularis communis, motor oculi, par tertium). It comes off from the under surface of the cerebrum, on the inside of the crus cerebri, where adjacent to the edge of the pons Varolii. It then passes forward and outward, perforates the dura mater at the side of the posterior clinoid process, takes its course along the upper and outer part of the cavernous sinus, enters the orbit through the lacerated foramen of the orbit, and divides into branches.

1. *Branch* to the levator oculi, which detaches a twig or two to the levator palpebræ superioris.
2. *Branch* to the adductor oculi.
3. *Branch* to the depressor oculi.

4. *Branch*, the longest and slenderest, to the inferior oblique, with which commonly passes off the—

5. *Branch* to the lenticular ganglion.

IV. INNER OCULO-MUSCULAR (N. oculo-muscularis internus, superior, patheticus, par quartum). Is the smallest of the cerebral nerves. From its origin behind the corpora quadrigemina it takes its course downwards and turns round the crus cerebri; then passes forwards through the dura mater near the posterior clinoid process, continues along the cavernous sinus, and enters the orbit through the foramen lacerum. It goes obliquely forwards and inwards immediately under the upper part of the orbit, and penetrates the superior oblique muscle, to which it is entirely distributed.

V. TRIGEMINAL (N. trigeminus, par quintum). Is a nerve of considerable size. It comes off from the brain at the under surface of that part of the crus cerebelli, which extends from the pons Varolii, and is there distinctly fasciculated. It passes forwards towards the upper edge of the petrous portion of the temporal bone, and is continued under the dura upon the surface of the petrous portion. It here forms close on the outside of the cavernous sinus, the semilunar ganglion or plexus (ganglion semilunare, plexus gangliformis), an enlargement of a semilunar form, with its concave edge placed backwards and upwards, and its convexity downwards and forwards, in which the numerous fibrillæ of which the nerve is composed, are interwoven with each other. From the anterior part of the plexus three principal nerves are formed:—1. Ophthalmic—2. Superior maxillary—3. Inferior maxillary.

1. FIRST BRANCH OF THE FIFTH PAIR, OPHTHALMIC (ramus primus, ophthalmicus). Is the smallest; it takes its course forward along the outer side of the cavernous sinus, is connected with the fourth pair, and passes into the orbit through the lacerated opening. Commonly just before its entrance into the orbit it divides into two or three branches, viz.

1. *Supra orbitar* (N. supra orbitalis, frontalis). The most considerable branch. It passes forwards immediately under the orbitar process of the frontal bone; is continued upward through the foramen supra orbitarium, or in the notch when the foramen is not distinct, and is distributed to the skin of the fore and upper part of the head. It detaches in the orbit:

α. *Branch* (N. supra-trochlearis), which takes its course more on the inner side, and is distributed to the upper eyelid and forehead.

2. *Nasal* (R. nasalis, naso-ocularis). Takes its course inwards over the optic nerve, and under the levator oculi, then under the superior oblique, and along the inner side of the orbit to the inner corner of the eye, and is divided into branches to the lacrymal sac and caruncle, and to the parts about the inner canthus. It sends off:—

α. A branch near its commencement to the lenticular ganglion.

The OPHTHALMIC or LENTICULAR GANGLION is of small size. It is situated on the outside of the optic nerve, surrounded by fat and cellular membrane. From this ganglion are passing the ciliary nerves (N. ciliares), about twelve or fourteen small filaments, several of which are frequently coming off from the nasal nerve. The ciliary nerves run along the optic nerve, penetrate the sclerotic coat, pass upon the choroid, detaching some small twigs to it, and are principally distributed to the iris.

β. *Ethmoidal* (N. ethmoidalis), which passes through the foramen orbitarium internum anterius, into the cranium, descends through one of the anterior openings of the cribriform plate of the ethmoid bone into the nose, and continues its course along the fore part of the septum to the point of the nose, distributing branches to the membrane at the fore part of the nose.

3. *Lacrymal* directs its course along the upper and outer part of the orbit, and divides anteriorly into branches to the lacrymal gland, and to the adjacent parts of the eyelid and cheek. One branch forms a connexion with one of the branches of the second division of the fifth pair.

2. SECOND BRANCH OF THE FIFTH PAIR, SUPERIOR MAXILLARY (R. secundus, N. maxillaris superior). Passes forwards and issues from the cranium through the round opening (foramen rotundum) of the sphenoid bone, and is lodged in a space left between the bones behind the orbit, where it divides into branches.

1. *Malar* (subcutaneus malæ), which passes into the orbit, furnishing small twigs, and after passing through a foramen in the malar bone is distributed to the adjacent parts.

2. *Spheno-palatine* (N. spheno-palatini, nasales, nasales laterales). They sometimes come off immediately from the trunk; but sometimes the trunk first divides into two or three branches which are then again united by a gangliform enlargement called the SPHENO-PALATINE GANGLION (G. Meckelii), from which these branches together with the palatine and Vidian branches are given off. The spheno-palatine nerve soon divides into three or four considerable branches, which pass inwards

through the spheno-palatine foramen, into the nose, and are distributed to the membrane of the posterior ethmoidal cells, sphenoidal sinus, eustachian tube, outer and back part of the side of the nose, and of the back part of the septum. One branch after passing over the septum is continued through the foramen incisivum to the roof of the mouth; and sometimes forms a *ganglion* (G. naso-palatinum) described by Cloquet.

3. *Pterygoid* (N. pterygoideus, vidianus, anastomoticus). Comes off from the spheno-palatine ganglion, or by a trunk in common with the spheno-palatine nerve. It directs its course backward through the pterygoid canal or foramen, and in it divides into two branches:—

α. *Superficial* (N. petrosus superficialis), which passes into the skull through the cartilaginous and membranous substance, which fills up the opening between the sphenoid bone and petrous portion of the temporal bone; is continued backwards in a groove upon the latter, and passing through a small opening into the canal of Fallopius, joins with the facial nerve.

β. *Deep* (N. profundus). After issuing from the pterygoid canal, passes backwards into the carotid canal, and there joins with the branches which form the communication between the sympathetic and the fifth and sixth nerves of the brain.

4. *Palatine* (N. palatinus, palato-maxillaris). Descends in the fossa between the pterygoid process of the sphenoid bone and the palatine bone, and divides usually into three branches. The largest of the three descends through the pterygo-palatine canal, furnishing some branches to the membrane at the back part of the nose, and after passing inferiorly through the posterior palatine foramen, is continued upon the under surface of the bony palate; upon which it divides into three or four considerable branches, which take their course between the bone and membrane at the root of the alveolar process, and are distributed to the membrane of the mouth and gums. The two or three smaller, after passing some way in the canal with the larger, descend through separate bony passages, and are distributed to the tonsil, velum palati, and the pillars of the fauces.

5. *Alveolar* (N. alveolaris, dentalis). It passes down upon the posterior surface of the tuberosity of the superior maxilla, and divides into branches distributed to the cheek and buccinator muscle, and other branches which pass through small canals in the bone to the membrane lining the antrum, and to the molar teeth of the upper jaw.

6. *Infra-orbitar* (N. infra-orbitalis). Appears like the continuation of the nerve itself. It is directed forwards, and takes its course through the infra-orbitar canal. Within

the canal it gives off branches, which, passing through passages in the upper jaw, are distributed to the membrane of the nose, and to the incisor, cuspidati, and the bicuspides teeth of the upper jaw. It then passes through the infra-orbitar foramen, and immediately divides into a number of considerable branches, distributed to the skin and muscles of the cheek, to the under eye-lid, nose, and upper lip.

3. THIRD BRANCH OF THE FIFTH PAIR. INFERIOR MAXILLARY (R. tertius, maxillaris superior). The largest of the three branches from the semilunar ganglion. It passes downward and forwards, quits the cranium through the oval opening (foramen ovale), and becomes covered by the pterygoideus externus muscle. It then divides into principal branches distributed to the muscles of the lower jaw, which sometimes come off by a single trunk, and to the tongue and the lower jaw: viz.

1. *Deep temporal* (N. temporales profundi). Commonly two in number, distributed to the temporalis muscle.

2. *Masseterine* (N. massetericus). Passes along the outer side of the pterygoideus externus, behind the tendon of the temporalis, to supply the masseter muscle.

3. *Buccal* (N. buccinatorius). Is of large size, passes downwards between the pterygoidei muscles to the buccinator, and furnishes branches to the pterygoideus internus and buccinator muscles, and to the membrane and glands of the cheek.

4. *Pterygoid* (N. pterygoideus). Distributed to the pterygoideus internus muscle.

5. *Temporal.* Passes outwards behind the neck of the lower jaw, divides into twigs to the ear, and to the side of the head, and forms communications with branches of the facial nerve. After giving off these branches, the trunk divides into the dental and gustatory.

6. *Dental, alveolar* (N. dentalis, alveolaris maxillæ inferioris, maxillaris inferior). Passes downwards and outwards first between the pterygoidei, and then between the pterygoideus externus and the condyle of the lower jaw to the posterior maxillary foramen. Before entering that opening it detaches a branch which takes its course on the inside of the lower jaw to the mylo-hyoideus, to which and to the submaxillary gland it is distributed. The nerve then enters the alveolar canal, along which it passes, distributing branches in its course to the teeth of the under jaw. It passes out through the mental foramen and divides under the depressor anguli oris into branches distributed to the skin and muscles of the chin and lower lip, and to the membrane and glands of the mouth.

7. *Lingual, gustatory* (N. lingualis, gustatorius). Takes its course downward and forward behind the pterygoideus externus, where it receives the communicating branch, (the chorda tympani) of the facial; is continued between the pterygoidei, then between the internus and the ascending plate of the lower jaw. Near the angle of the jaw, and above the submaxillary gland, it sends branches to this gland, which sometimes come off from an enlargement of the nerve called the *maxillary ganglion*. The nerve then passes forward with the duct of the submaxillary gland, between the sublingual gland and the hyo-glossus muscle, giving off branches to the sublingual gland and to the membrane of the mouth, which communicate with the lingual nerve; and divides into branches, which passing principally to the apex and sides of the tongue, are distributed to the skin which covers these.

VI. OUTER OCULO-MUSCULAR (N. oculo-muscularis externus, abducens, par sextum). Takes its course from the posterior edge of the pons Varolii, forward and outward, passes through the dura mater near the posterior clinoid process, and is continued on the outer side of the internal carotid artery along the cavernous sinus, protected from the blood which it contains by the lining membrane of the sinus. It detaches some filaments by which it is connected with the sympathetic, and passing through the foramen lacerum orbitale, is distributed entirely to the abductor oculi. It sometimes detaches a twig to the lenticular ganglion.

VII. AUDITORY (N. auditorius, acusticus, portio mollis, par septimum). After passing round the crus cerebelli, it takes its course outwards and forwards, and enters the meatus auditorius internus, along which it is continued. In this canal it divides into two branches for the supply of the labyrinth of the ear; one which is distributed to the membrane of the cochlea, and the other to that of the vestibule and of the semi-circular canals.

VIII. FACIAL (N. facialis, communicans faciei, portio dura septimi paris). Consists of two portions, one larger; and one smaller, called the portio media, situated between the former and the auditory nerve. Takes its course with the auditory nerve, being received in a depression on its inner side, and is continued with it through the meatus auditorius internus. At the bottom of this passage it separates from the auditory nerve or portio mollis; passes through the canal of Fallopius, and quits this canal at the stylo-mastoid foramen. In the canal of Fallopius, it receives the recurrent or superficial branch of the Vidian, and is thereby connected with the second division of the fifth pair. It detaches small twigs to the tympanum, and sends off a considerable branch, the—

1. CHORDA TYMPANI, which directed upwards, enters the tympanum from behind, then passes forward between the malleus and incus, quits the tympanum through the fissura Glaseri, and on the inside of the ascending plate of the lower jaw, joins with the lingual branch of the inferior maxillary nerve.

The *facial nerve*, after issuing from the stylo-mastoid foramen, is directed forward and a little downwards, situated deep behind the parotid gland. It gives off:—

2. BRANCHES to the auricle and to the parts about the angle of the jaw; viz.

α. Branch called auricular (auricularis), which ascends behind the ear, and is distributed to the back of the ear and to the head—*β. Branch* (N. stylo-hyoideus), distributed to the muscles attached to the styloid process, and giving off some twigs of connexion with the sympathetic and cervical nerves—*γ. Branch* (N. digastricus), distributed to the digastric muscle, and supplying branches of connexion with the glosso-pharyngeal and accessory nerves.

The *facial nerve* then enters the parotid gland, crosses the external carotid artery, and divides into four or five branches, forming by their junctions a kind of plexus, called the PAROTID PLEXUS (plexus parotideus), from which branches are sent off to the side of the face and neck.

The branches from the parotid plexus are divided into—

3. TEMPORAL (N. temporales). Two or three in number, which supply small branches to the parotid gland, ascend over the zygoma to the temple, and extend as far as the forehead, furnishing twigs to the skin and muscles, and forming communications with the frontal and lacrymal branches of the first branch of the fifth pair.

4. SUPERIOR FACIAL (N. malares). Commonly two small branches, which pass more forwards than the former, and are distributed to the orbicularis palpebrarum, and to the parts about the outer angle of the eye.

5. MIDDLE FACIAL, BUCCAL (N. buccales). Two or three in number; they pass forwards over the masseter muscle, the largest accompanying the parotid duct, and are distributed to the skin and muscles of the cheek, to the side of the nose, and the lips. They form communications with branches of the infra-orbitar nerve, and the buccal branches of the third branch of the fifth pair.

6. Inferior Facial. Passes forward over the lower part of the masseter, and is distributed to the skin and muscles of the lower lip.

7. Descending. Commonly two in number. The upper passes forwards along the edge of the lower jaw, is distributed to the skin and muscles of the chin and lower lip, and joins with branches of the dental nerve: the lower divides into two or three branches, which descend upon the side of the neck, are distributed to the skin and platysma myoides, and form junctions with branches of the third cervical nerve.

IX. Glosso-pharyngeal (N. glosso-pharyngeus). It passes forward and outward with the pneumo-gastric nerve, of which, until of late, it has been considered a part, and is continued with it through the foramen lacerum basis cranii. At this part it has a gangliform enlargement, from which filaments are given off, forming connexions with the recurrent branch of the Vidian, with the sympathetic, and with the pneumo-gastric and accessory nerves. It then passes down before the internal jugular vein, quits the pneumo-gastric nerve, and is continued downward and forward between the carotid arteries, and along the stylo-pharyngeus, to the under and back part of the tongue. Soon after issuing from the cranium, it is connected by a filament with the facial, and by another with the pneumo-gastric, and detaches one or two filaments, which descending along the internal carotid, and then along the common carotid artery, join with filaments of the pharyngeal branch of the pneumo-gastric, and at the lower part of the neck with the superficial cardiac nerve. The glosso-pharyngeal detaches also twigs to the stylo-pharyngeus, the constrictores pharyngis, and to the tonsil, and divides into branches to the parts about the passage of the fauces, the muscular structure of the tongue, and to the skin and papillæ at the root of the tongue.

X. Pneumo-gastric (N. pneumo-gastricus, vagus, par octavum). It passes out of the cranium with the former nerve, through the lacerated foramen, and is continued through the neck and chest into the abdomen, terminating by distributing branches to the stomach, and in its course furnishing branches to the upper part of the alimentary canal and to the respiratory organs. It is at first situated before the internal jugular vein; and is closely conneced by cellular membrane with the glosso-pharyngeal, the lingual, and the sympathetic nerve. It then descends, separated from the glosso-pharyngeal by the internal jugular vein, and quitting the lingual nerve; and passes through the neck rather before the common carotid artery, between it and the internal jugular vein, and included in the same sheath of cellular substance with these vessels. It is continued into the chest, passing on the right side, between the subclavian vein and artery, and on the left side before the arch of the aorta. It then takes its course through the posterior mediastinum by the side of the œsophagus, and is continued with it through the diaphragm, terminating by branches to the stomach. It gives off:—

1. SMALL BRANCHES. Small ones of communication with the accessory and glosso-pharyngeal nerve, and with the superior cervical ganglion.

2. PHARYNGEAL (N. pharyngeus). Formed in part by a branch or two from the accessory nerve. It passes downwards on the inner side of the internal carotid artery, forms on the pharynx the *pharyngeal plexus* (pl. pharyngeus), which receives likewise filaments from the laryngeal and glosso pharyngeal nerves, and from the superior cervical ganglion, and is distributed to the constrictors of the pharynx; some filaments descending upon the carotid with those of the glosso-pharyngeal. Near the point at which the pharyngeal branch is given off, the pneumo-gastric nerve becomes enlarged, softer, and redder, so as to present the appearance of a ganglion at that part.

3. LARYNGEAL (N. laryngeus, laryngeus superior). Arises commonly from the enlargement above-mentioned. It passes downward and forward, receiving some filaments from the pharyngeal plexus, and from the glosso-pharyngeal nerve; and divides into an external and an internal branch.

α. *External* is distributed to the inferior constrictor of the pharynx, to the muscles of the larynx, and by some twigs to the thyroid gland and membrane of the larynx.

β. *Internal* takes its course between the os hyoides and thyroid cartilage to the interior of the larynx, and divides into branches to the muscles of the arytenoid cartilages, the mucous glands, and membrane of the larynx.

4. FILAMENTS, which accompany those of the pharyngeal and glosso-pharyngeal upon the carotid artery.

5. CARDIAC BRANCHES (Rami cardiaci). Two or three in number, of small size, which arise about the middle of the neck, descend along the outer and fore part of the carotid, join with the superficial cardiac branches, and are spread upon the arch of the aorta.

6. Recurrent (N. recurrens, laryngeus inferior). Arises as soon as the nerve enters the chest; the left, however, is given off lower than the right. It first descends directed backwards, then passes upward behind the subclavian artery on the right side, and behind the arch of the aorta on the left, and ascends between the œsophagus and trachea, as high as the larynx, where it divides into branches distributed to the inferior constrictor of the pharynx, to the muscles of the arytenoid cartilages, and to the lining membrane of the larynx; forming junctions by several filaments with branches of the laryngeus superior. In its course the recurrent nerve distributes numerous branches; viz.

α. *Filaments,* which join with the cardiac branches of the pneumo-gastric, and with those of the great sympathetic, passing to the cardiac plexus.

β. *Tracheal* (R. tracheales interiores) which are distributed to the lining membrane of the trachea, to the pharynx, and œsophagus; some of these descending before the air-tube join with the former, and with the pulmonary plexus.

7. Pulmonary (R. tracheales inferiores). Five or six small branches, given off behind the root of the lung, which pass partly before and partly behind the air-tube and its branches forming the *pulmonary plexus.* The anterior join with the filaments from the recurrent, and with some from the inferior cervical ganglion. The posterior filaments of the pulmonary plexus, are formed in part likewise by filaments from the superior thoracic ganglion. The branches from the plexus are continued with the bronchia on each side, and are distributed principally to the lining membrane of their ramifications.

8. Œsophageal. After the pneumo-gastric has given off the pulmonary branches, it divides on the right side into five or six, and on the left side into two or three fasciculi; these separate, but are connected by several communicating branches, forming the *œsophageal plexus.* The branches again unite forming a cord on each side, which descends upon the œsophagus, and connected by anterior branches, distributes filaments to the œsophagus and aorta.

9. Coronary. The two branches above described descend with the œsophagus through the aperture of the diaphragm and terminate on the stomach. The right is distributed on the right side and posterior surface, it forms an intricate plexus about the cardia, sends branches along the less curvature, and forms junctions with the left branch, and with filaments of the sympathetic,

distributed to the stomach, and forming the solar plexus. The left is distributed to the anterior surface by several branches, extending towards the pylorus, and form junctions with filaments of the right, and with branches of the sympathetic. The distribution of these branches, by which the pneumo-gastric terminates, is called the *coronary* or *stomachic plexus.*

XI. LINGUAL (N. lingualis, hypo-glossus). Comes off from the anterior surface of the medulla oblongata, by several separate fasciculi, which, after passing through the dura mater in two or three divisions, unite to form a single nerve, continued through the anterior chondyloid foramen. It takes its course downwards, is joined by a twig from the pneumo-gastric, from the sub-occipital nerve, and from the superior cervical ganglion, and appearing between the internal carotid artery and internal jugular vein, is then directed forwards in a bend and crosses over both carotids, at the origin of the occipital artery; it continues its course behind the termination of the facial vein, and before the external carotid artery, near the os hyoides passing behind the digastricus and stylo-hyoideus, between them and the stylo-glossus. The lingual nerve is in contact with the corresponding artery, until it has reached the side of the tongue, but here is continued forwards upon the hyo-glossus muscle, dividing into branches, distributed to the muscles under the tongue and to the fleshy part of the tongue itself, and joining by one or two branches with the gustatory branch of the fifth pair.

It sends off in its course the :—

1. *Descending branch* (R. descendens noni). Which comes off near the root of the occipital artery. It descends along the external carotid artery, and lower on the inner side of the internal jugular vein, and is sometimes included in the sheath of the vessels. It then turns forward, sending a branch to the omo-hyoideus, and filaments to the muscles of the larynx; and forms an arch, with a branch from the second and third cervical nerves, from which branches are given off to the omo-hyoideus, sterno-hyoideus, and sterno-thyroideus.

2. *Muscular branches.* Distributedto muscles between the maxilla and the os hyoides.

§ 2. SPINAL NERVES.

They consist of thirty-one pairs divided into the cervical, dorsal, lumbar and sacral nerves.

CERVICAL NERVES.

1. Accessory (N. spinalis ad par vagum accessorius, N. accessorius Willisii). Arises from the back part of the lateral surface of the spinal marrow by numerous filaments, which come off close to the posterior roots of all the cervical nerves; although sometimes it has fewer roots. It passes up near the posterior roots of the upper cervical nerves, and enters the cranium through the foramen magnum; then takes its course with the pneumo-gastric, and passes with it through the lacerated opening of the skull; but, sometimes, through a separate opening of the dura mater. It then detaches a branch, which forms a junction by separate filaments, with the pharyngeal and pneumo-gastric nerves. The nerve descends behind the internal jugular vein, then between this vessel and the sterno-mastoid muscle; passes through the sterno-mastoid detaching branches which unite with branches of the second and third cervical nerves, with twigs of the fourth and fifth, and terminates on the inner surface of the trapezius.

2. Suboccipital (N. infra-occipitalis, cervicalis primus, decimus cerebri). Is of very small size. It arises from the beginning of the spinal cord on its fore part, commonly by a single root, and sometimes by two, like the other spinal nerves. It passes out between the occipital bone and the transverse process of the atlas, where it becomes slightly enlarged, and at the posterior edge of the atlas, divides into two branches. The anterior smaller passes forwards between the transverse process of the first vertebra and the mastoid process, divides into filaments, joining with the first cervical, the lingual and the sympathetic nerve, and furnishes twigs to the adjacent parts. The posterior larger passes backward, and divides into branches to the recti and obliqui capitis.

The other Cervical Nerves consist of seven pair. The three upper cervical are smaller than the lower. The anterior branches of the upper form junctions with each other, soon after passing from the vertebral foramina, and from these other branches arise, which again uniting and dividing, form an intricate plexus, which has been called the *cervical plexus:* from this plexus nerves of communication pass to the sub-occipital nerve and to the superior and middle cervical ganglion of the sympathetic, and some anatomists describe all the cervical branches as originating from it.

1. Cervical (N. cervicalis primus). Passes out

between the atlas and dentata, and divides into two branches, an anterior and posterior.

1. *Anterior*, or smaller, passes forward, sends a branch upward, which joins with the first cervical, from which filaments are detached to join with the superior cervical ganglion, with the lingual, and the pneumo-gastric nerve; and sends a branch downward to join with the second cervical.

2. *Posterior*, larger, or occipital branch, (N. occipitalis maximus), is directed backward, and, after furnishing branches to the extensors of the head and neck, ascends upon the occiput, and divides into branches to the skin and occipito-frontalis, some of its filaments forming junctions with branches of the fifth pair and the facial nerve.

2. CERVICAL (N. cervicalis secundus). Larger than the former, passes out between the second and third vertebra, and divides into an anterior and posterior branch.

1. *Anterior*. Supplies some filaments to the muscles on the fore part of the vertebræ, detaches branches to join with the upper cervical ganglion, and with the first and third cervical nerves, by which junctions are formed with the descending branch of the lingual and with the accessory nerve, then divides into two branches, the superficial of the neck and the small occipital.

α. *Superficial* of the neck (N. superficialis colli). Bends round the posterior edge of the sterno-mastoid and divides into branches (N. subcutanei), which spread on the side of the neck, and are distributed to the skin especially about the lower jaw, forming several communications with each other, and with branches of the facial nerve. One of its branches, the auricular (N. auricularis magnus), takes its course directly upward behind the jaw to the auricle, and furnishes branches to its skin and muscles.

β. *Small occipital* (N. occipitalis minor). Passes upward, commonly soon dividing into several branches, over the splenius and trachelo-mastoideus, forms junctions with branches of the facial and occipital nerves, and is distributed to the skin of the occiput and back part of the ear, and to the adjacent parts.

2. *Posterior* smaller passes backwards between the muscles, detaches branches of connexion to the first and third cervical, and is distributed to the extensors of the head and neck, and to the skin of the neck.

3. CERVICAL (N. cervicalis tertius), is smaller than the former. It passes out between the third and fourth vertebra, and divides into an anterior and posterior branch.

1. *Anterior,* larger, detaches a branch to join with the fourth, and another with the second cervical, a branch which joins with the great sympathetic or superior cervical ganglion, and a branch which joins with the descending branch of the lingual. It furnishes branches to the longus colli, and levator scapulæ, and divides then into three or four branches (N. supraclaviculares) which descend and are distributed to the skin about the clavicle and adjacent parts.

2. *Posterior,* smaller. It passes deep-seated between the muscles, and is distributed to the extensors of the head and neck.

DIAPHRAGMATIC NERVE (N. phrenicus, diaphragmaticus). Arises by different filaments from the lower cervical nerves; the most considerable filament is from the anterior branch of the fourth, but it receives a smaller from the third, and commonly one from the second, and often a filament or two from the axillary plexus. It takes its course downward between the rectus capitis and scalenus anticus, and enters the chest behind the first rib, between the subclavian artery and vein. It is then directed forwards, passes before the root of the lung, and descends between the pericardium and pleura. As it approaches the diaphragm it divides into several branches which are distributed to the convex part of that muscle. Some of the branches pass through the diaphragm with the inferior cava, distribute filaments to the under surface of the diaphragm, and form connexions with filaments of the solar plexus. The left lies farther back, is longer than the right, and furnishes some twigs to the œsophagus.

The FOUR INFERIOR CERVICAL AND THE FIRST DORSAL NERVE are of large size, especially the sixth cervical. These form by their junctions the axillary plexus, from which the nerves originate supplying the upper extremity. They pass out under the corresponding vertebræ, and after issuing from the vertebral foramina, send small branches to the muscles of the back: take their course outward and downward between the scalenus anticus and medius, accompanying the subclavian vessels, being situated above and behind, and to the outer side of the artery. They pass with these vessels under the clavicle, and retain the same relative position with respect to the axillary vessels, as far as the part opposite to the coracoid process of the scapula:

but they here pass before the artery so as to conceal it. During this course the nerves divide, join and separate again, so as to form the AXILLARY or BRACHIAL PLEXUS. The nerves which come off from the plexus are the--

1. Thoracic. 2. Scapular. 3. Articular. 4. Inner cutaneous. 5. Inner smaller cutaneous. 6. Outer cutaneous. 7. Radial. 8. Median. 9. Ulnar.

§ 3. NERVES FROM THE AXILLARY PLEXUS.

1. THORACIC (N. thoracici). Consist of branches derived from the fourth, fifth, and sixth cervical. They descend upon the parietes of the chest, and are distributed to the subclavius, the pectorales, and skin of the chest and shoulder; one branch commonly descending upon the serratus magnus, and distributed to it.

2. SCAPULAR (N. scapularis). Frequently from the fourth and fifth cervical. Passes downward and backward, is continued through the notch of the scapula to the fossa supra-spinata, and furnishes twigs to the supra-spinatus: then directs its course along the root of the acromion, and divides into branches for the supply of the infra-spinatus and teres minor.

3. ARTICULAR (N. articularis, circumflexus brachii) Arises from the trunk formed by the junction of the fourth and fifth cervical. It detaches twigs to the subscapularis and to the teres major and minor, and takes its course, between the two last named muscles and the long head of the triceps, round the os humeri just below the head, to the inner surface of the deltoid, to which it is distributed. One branch passes through the muscle, and divides into twigs to the skin.

4. INNER CUTANEOUS (N. cutaneus internus). Generally formed by several fibrillæ of the first dorsal, and sometimes in part from the seventh cervical. It takes its course down the inner side of the arm, immediately under the skin, in the course of the basilic vein, and near the radial nerve, and after detaching one or two inconsiderable twigs as it approaches the elbow, divides into two branches:—of which the smaller is directed backward, and runs down on the inner and back part of the fore arm, dividing and distributing twigs to the skin as far as the little finger:—the other and larger descends on the inner and fore part of the fore arm, dividing into several twigs which pass partly over and partly behind the subcutaneous veins, and supply the skin as far as the wrist and the palm of the hand.

5. Inner Small Cutaneous (N. cutaneus internus minor). Is connected principally with the ulnar nerve, and is much smaller than the former. It soon divides into two branches which distribute twigs to the biceps and to the skin of the back part of the arm, and of the elbow.

6. Outer Cutaneous (N. cutaneus externus, musculo-cutaneus, perforans). Formed by the fourth, fifth, and sixth cervical, and sometimes by a branch of the median. It passes downward and outward, perforates commonly the coraco-brachialis, or takes its course on the inside of the muscle, and furnishes some twigs to it. It descends then between the biceps and brachialis internus, giving off some branches to both, as far as the bend of the elbow, where it is situated on the outer side of the tendon of the biceps, between it and the cephalic vein. It continues its course on the outer side of the fore arm under the skin, to which it distributes numerous twigs, as far as the root of the thumb and back of the hand.

7. Radial (N. radialis, spiralis). Is of large size, and is formed by fasciculi from all the nerves of the axillary plexus. It takes a spiral direction, directing its course behind the os humeri between the two heads of the triceps; it then makes its appearance on the outer side of the arm, descends between the brachialis internus and extensores carpi radiales, and divides into a superficial and deep branch. Before the division it distributes—

1. *Branches* to muscles—a branch to the latissimus dorsi—branches to the heads of the triceps.

2. *Cutaneous branch,* given off behind the body of the os humeri, which descends on the outer and back of the arm, and is distributed to the skin of the fore arm.

3. *Branches* to the supinator longus and extensors.

4. *Superficial* (R. superficialis dorsalis). Descends on the inner side of the supinator longus, giving off some twigs to the radial extensors, and then accompanies for some way the radial artery; but towards the lower part of the fore arm it passes backward under the tendon of the supinator longus, and divides into two branches, a dorsal and a palmar.

α. *Palmar* passes to the thumb, furnishing twigs to the skin of the wrist and to the muscles and skin of the thumb, and terminates on the skin of the back part of the thumb. It forms junctions with twigs of the external cutaneous nerve.

β. *Dorsal* divides into twigs distributed to the skin of the back of the hand, to the muscles between the index and thumb, and its principal branches are disposed on each side of the fore and middle finger, and on the outer side of the ring-finger.

5. *Deep* (R. profundus, muscularis), passes deep-seated backward upon or through the supinator brevis, and descends on the back of the arm, between the extensors of the fingers, taking its course under the extensor digitorum and the extensor primi internodii pollicis, as far as the wrist, to the parts about which it is ultimately distributed. In its course it furnishes branches to the supinator brevis, extensores radiales, and to the extensors of the thumb and fingers.

8. MEDIAN (N. medianus). The most considerable of the nerves from the axillary plexus; formed by fasciculi from all the nerves composing this plexus. It descends on the inner side of the biceps, with the brachial artery, situated on the inner and fore part of this vessel as far as the bend of the elbow: here passes over the tendon of the brachialis internus, and descends through the fore arm about midway between the radius and ulna. In the fore arm it takes its course first behind, or through, the pronator teres, and continues its course between the flexors of the fingers. At the lower part of the fore arm it commonly divides, the branches being continued behind the annular ligament of the wrist, between the tendons of the flexors, to the palm of the hand, and here sub-dividing into branches to the thumb and fingers. The median in its course through the upper arm, furnishes only some inconsiderable twigs to the coats of the vessels. As it approaches the elbow it detaches:—

1. *Branches* to the pronator teres, palmaris longus, flexor carpi radialis, and flexor sublimis.

2. *Interosseous* (N. interosseus), given off at the bend of the joint, which after giving off branches to the flexor profundus and flexor pollicis, descends upon the interosseous ligament, with the corresponding vessels, turns over the edge of the pronator quadratus, and terminates in that muscle.

3. *Palmar*, a cutaneous branch given off near the wrist, and supplying the adjacent skin, and that of the back of the thumb.

The branches into which it divides in the palm of the hand are three or four in number, viz.—

4. *Branch*, which divides into two to the thumb, and one to the fore finger; of which the former pass at the sides of the thumb to its extremity, and the latter takes its course along the outer side of the fore finger.

5. *Digital Branch*, which passes to the interstice between the roots of the fore and middle finger, and here

divides into two, one of which passes along the inner side of the fore finger, and the other along the outer side of the middle finger, severally to the tip of each.

6. *Digital Branch,* which passes to the interstice between the roots of the middle and ring-finger, where it divides like the former into two branches which are continued, the one along the outer side of the middle, and the other along the inner side of the ring-finger, to their tips. These and the preceding digital branches furnish twigs to the skin of the fingers, but are principally distributed to the skin of the tips of the fingers.

9. ULNAR (N. ulnaris, cubitalis). Somewhat smaller than the former. Is formed from the three undermost nerves of the plexus. As it descends it is inclined backward on the triceps muscle with which it is connected. Near the elbow it passes backward behind the inner condyle of the os humeri, situated in the groove between the condyle and the olecranon process of the ulna, with the recurrent ulnar artery. It takes its course between the flexor carpi ulnaris and extensor digitorum, and then descends on the inner side of the fore arm with the ulnar artery, being situated on the inner side of the artery. It passes with this vessel over the annular ligament into the palm of the hand, and here terminates by dividing into a superficial and deep branch. In its course through the upper arm it detaches no branches, except, in some cases, the inner cutaneous nerve. In the fore arm it gives off:—

1. *Branches* near the elbow to the flexor ulnaris and flexor profundus.

2. *Cutaneous* branch, which descends under the skin, in the course of the basilic vein, and is distributed to the skin as far as the hand.

3. *Dorsal* (N. ulnaris dorsalis) given off at the lower part of the fore arm: passes backward between the flexor ulnaris and ulna, and divides into twigs, supplying the skin of the back of the hand, and the skin of the ring-finger and little finger, and forming junctions with twigs of the spiral nerve.

Of the two branches by which it terminates:

4. *Superficial palmar* is connected by one or more twigs to branches of the median. It gives off:—

α. *Branches* distributed to the muscles of the little finger.

β. *Digital branch,* which is continued along the inner side of the little finger to its tip.

γ. *Digital branch,* which passes to the interstice between the roots of the ring and little fingers, and there divides, sending one branch along the outer side of the little finger, and another along the inner side of the ring-finger to their extremity. These branches are distributed like those of the median.

5. *Deep palmar* passes deep-seated between the flexor and abductor of the little finger, and is then directed transversely outward behind the tendons of the flexors, furnishing twigs to the lumbricales, the interossei, and adductor pollicis muscle.

§ 4. THORACIC NERVES.

Consist of *twelve* pairs: are comparatively of small size. The first pair has been already spoken of with the lower cervical as entering into the composition of the axillary plexus; the remaining eleven only, therefore, remain to be described.

Immediately after passing out of the vertebral foramina, each nerve is connected by short branches with the nearest ganglion of the sympathetic, and soon after divides into two branches, an anterior and a posterior.

1. POSTERIOR. Passes backward between the transverse processes of the vertebræ, and is distributed to the muscles situated near the spine.

2. ANTERIOR. Takes its course under that rib, under which the trunk issues from the vertebral canal, between the layers of intercostal muscles with the intercostal vessels, and more or less in the costal groove; but as it advances it becomes farther removed from the upper rib, and, near the sternum, passes upon the exterior of the chest. In its course it furnishes branches to the intercostal muscles, the upper part of the abdominal muscles, and twigs which, penetrating the intercostal muscles, are distributed to the muscles of the upper extremity and skin covering the chest.

There are, however, some differences to be observed in these nerves. The first is the largest; the second is much smaller, and from the second they then increase in size, but not regularly, to the twelfth. There is also some difference in the distribution of the anterior or intercostal branches.

The *first thoracic nerve* takes its course upward and outward over the first rib to join the axillary plexus; opposite that rib dividing into two branches, one of which joins with the axillary plexus, as above described, whilst the other smaller branch takes its course under the first rib like the other intercostal branches.

The *second* and *third* differ from the rest in detaching each a branch, called *intercosto-humeral*, to the skin of the upper arm. These two branches penetrate the intercostal muscles under the second and third ribs, and are distributed to the skin of axilla and inner part of the arm as far as the elbow.

The *five uppermost* are distributed principally to the pectorales and serratus muscles. The seven lowermost principally to the abdominal muscles. The eleventh and twelfth distribute branches to the lesser muscle of the diaphragm, to the quadratus and the psoas muscle. The rest of their distribution is as before described.

The *twelfth dorsal* is connected by a small branch with the first lumbar.

§ 5. LUMBAR AND SACRAL NERVES.

There are five pairs of lumbar, and five pairs of sacral nerves. The *lumbar* pass through the foramina formed by the lumbar vertebræ, and the last nerve through the foramen, formed by the last vertebra and the sacrum. The *sacral* take their course through the anterior sacral foramina, and the last between the sacrum and the os coccygis. The *anterior* branches of these nerves, ten in number on each side, form by their connexions a kind of plexus (sometimes described as the lumbar and sacral plexus), which may be termed the Crural Plexus: from this plexus the nerves are derived, supplying the whole of the lower extremity, the roots of the nerves being here variously intermingled and connected. The anterior branches of the lumbar nerves passing behind the psoas, are connected with each other; in addition the first being joined to the last dorsal, and the last to the first sacral nerve: the anterior branches of the sacral, especially the three uppermost, contribute in the same way by their junction to the formation of this plexus.

Of the nerves which form this plexus, those which are situated in the middle are the most considerable, that is to say, the fifth lumbar and the first sacral; they then diminish in size upward and downward, but not with exactness, the first lumbar and the third sacral being nearly of the same size, and the two last sacral the least, especially the fifth, which is generally the smallest of all the spinal nerves. The fourth and fifth sacral nerves are connected with the crural plexus, but do not contribute to form the principal nerves arising from it.

From all the nerves which enter into the composition of the crural plexus, small *dorsal* branches arise which take their course backward; those from the lumbar passing between the transverse processes of the lumbar vertebræ and of the sacrum; those passing from the sacral through the posterior sacral foramina: they are distributed to the under part of the muscles of the back, to the gluteus maximus and the adjacent skin.

BRANCHES FROM THE LUMBAR AND SACRAL NERVES, FORMING THE CRURAL PLEXUS.

Some of these are of small size, derived only from one or two of the nerves, viz. the external spermatic nerves, the branches distributed to the muscles of the loins, and the branches to the skin about the hip and groin, the gluteal nerves, &c. The larger are formed by fasciculi from several nerves: they are the obturator, pudic, crural, and ischiadic nerves.

1. EXTERNAL SPERMATIC (N. spermaticus externus, pudendus externus). Is derived from the first and second lumbar. It passes through the upper part of the psoas muscle, and descends on its anterior surface. It divides then into two branches, one of which accompanies the spermatic vessels, and distributes in the male branches to the scrotum, cremaster, and cord, in the female to the round ligament, and in both to the skin of the pubes and groin; the other branch passes behind Poupart's ligament, and is divided into branches to the integuments of the fore part of the thigh.

2. BRANCHES FROM THE FIRST AND SECOND LUMBAR, distributed to the psoas, quadratus, and transversalis abdominis muscles, and to the skin about the loins and hip. There are generally one or two long branches, which penetrate the psoas, take their course over the quadratus, pass through the transverse and internal oblique muscle of the abdomen, furnishing twigs to these muscles; are then continued through the tendon of the external oblique, and spread in the skin of the groin and scrotum.

3. EXTERNAL CUTANEOUS (N. cutaneus externus). Generally derived from the third lumbar. It takes its course between the psoas and iliacus, and descends upon the latter muscle. It is continued under the outer extremity of Poupart's ligament, and divides into branches, distributed to the skin of the fore and outer part of the thigh, as far as the knee.

4. SUPERIOR GLUTEAL (N. glutæus superior).—Is formed by the fourth and fifth lumbar, (before their junction with the first sacral, to form the ischiadic). It passes directly under the edge of the notch of the ilium, and is distributed to the small and middle gluteal muscles, some of the twigs extending as far as the tensor vaginæ femoris.

5. **Inferior Gluteal** (N. glutæus inferior). Is formed by fasciculi from the second and third sacral nerves; passes out of the pelvis under the pyriform muscle, to which it detaches twigs, and is distributed to the large gluteal muscle.

6. **Common Pudic.** Formed by fasciculi from the fourth and fifth lumbar, and from the three uppermost sacral nerves; it is of considerable size. It passes out of the pelvis through the under part of the notch of the ilium, then is continued into the pelvis again, between the two sacro-sciatic ligaments, and divides into a superior and inferior branch.

1. *Superior* (N. pudendus superior). Takes its course along the ramus of the ischium and that of the os pubis, giving off twigs to the obturator internus muscle, is then continued forwards under the symphysis pubis, in the male as the dorsal nerve of the penis (N. dorsalis penis), in the female as the nerve of the clitoris (N. clitorideus), and in both distributes twigs upon the dorsum, and to the skin of the pubes and adjacent parts, and terminates in the glans.

2. *Inferior* (N. pudendus inferior, hæmorrhoideus). Accompanies the superior for a short way, ascends then between the accelerator urinæ and erector penis, and is distributed to the skin and muscles of the perineum, to the extremity of the rectum, to the skin of the scrotum, and to the urethra, and is connected by various twigs with the other branches supplying the groin, the rectum, and parts of generation.

7. **Branches from the Third, Fourth, and Fifth Sacral.** Arise from these nerves separately; are distributed to the rectum, to the sphincter and levator ani muscles; to the bladder, uterus, and vagina, in the female; and to the bladder, prostate gland, and vesiculæ seminales, in the male; and assist in forming the hypogastric plexus.

8. **Obturator** (N. obturatorius). Is derived from the anterior fasciculi of the second, third, and fourth lumbar nerves; passes downward and forward from behind the psoas muscle, takes its course in the direction of the linea ilio-pectinea, accompanied by the vessels of the same name, and is continued through the aperture in the ligament which fills up the obturator foramen. It then divides into an anterior and posterior branch.

1. *Anterior.* Is distributed to the adductor longus and brevis, and to the gracilis, and is connected by different twigs with the saphænus.

2. *Posterior.* Is distributed to the obturatores and adductor magnus.

9. Crural (N. cruralis). Is more considerable than the obturator; derived from the junction of the principal 6 portions of the four upper lumbar nerves. It passes downward and outward, between the psoas and iliacus muscle, to both of which it furnishes twigs; continues its course on the outer side of the psoas, descends into the thigh behind Poupart's ligament, and here placed exterior to the sheath of the femoral vessels, on the outer side of the artery, and in the upper part of the thigh, divides into branches distributed to the skin and muscles.

1. *Superior Cutaneous* (N. cutaneus superior). Comes off sometimes above Poupart's ligament, and is joined by other twigs, arising near that part. It divides into from three to six branches, which are distributed to the skin, on the fore and inner part of the thigh, as far as the knee.

2. *Muscular branches.* Are considerable in size and number, and are distributed to the rectus, cruralis, vasti, adductores, and tensor vaginæ femoris muscle.

3. *Inferior Cutaneous* (N. cutaneus inferior, N. saphænus). Descends behind the sartorius muscle, to which it gives off some twigs, and on the inner side of the femoral artery, connected with and sometimes inclosed in the sheath, which contains this vessel. (N. B. There is a nerve accompanying the inferior cutaneous in its descent, which passes into the vastus internus, at the lower part of the thigh.) The inferior cutaneous continues its course through the tendon of the triceps, on the inner side of the knee becomes subcutaneous, and accompanies the saphæna vein in its course along the inner side of the leg to the inner and upper part of the foot. In its course, it distributes branches to the integuments of the knee and inner part of the leg and foot, as far as the great toe.

10. Ischiadic (N. ischiadicus). The largest nerve in the body, is formed by the junctions of the largest portions of the fourth and fifth lumbar, and of the three uppermost sacral nerves. It passes out of the pelvis, between the pyriformis and gemini muscles; sometimes penetrates the pyriformis muscle, and sometimes a slip of the pyriformis is interposed between its fasciculi. It takes its course over the rotator muscles, between the tuberosity of the ischium and trochanter major, covered by the large gluteal muscle; descends in the back part of the thigh, between the flexors of the leg and adductor magnus, and about the middle

of the thigh divides into the *tibial* and *peroneal* nerves. The division is seldom lower, but sometimes much higher, and occasionally above the tuberosity of the ischium, so that its two branches are separated by the pyriform muscle. The branches which it gives off are:—

1. *Twigs* to the obturator internus, gemini, and quadratus muscle.

2. *Branch*, connected with the inferior gluteal nerve, to the gluteus maximus.

3. *Branches* to the biceps, semitendinosus, semi-membranosus, and triceps muscles; these sometimes come off by a single trunk.

4. *Superior Cutaneous* (N. cutaneus superior posterior). Is sometimes separated from the trunk near to its origin. It divides into two branches, one is continued forwards, and distributes twigs to the skin about the tuberosity of the ischium and adjacent parts: the other descends along the back part of the thigh, and distributes twigs to the skin, as far as the calf of the leg.

5. *Inferior Cutaneous* (N. cutaneus posterior inferior). Is of small size, and distributed like the former.

PERONEAL (N. peroneus, fibularis). Passes downward on the inner side of the biceps, then winds forwards over the head of the fibula, and divides into a *superficial* and *deep* branch. Before this division it gives off a cutaneous branch: thus the branches of this nerve are:—

1. *Cutaneous* (N. cutaneus peroneus externus), which takes its course downward along the outer part of the leg, between the gastrocnemius and skin, and after being connected with a branch of the tibial, distributes branches to the outer side of the foot, and terminates by dorsal branches to the fourth and fifth toes.

2. *Superficial* (N. cutaneus peroneus internus). Passes downward and forward between the peroneus longus and brevis muscles, becomes subcutaneous about the middle of the leg, and is continued under the skin upon the dorsum of the foot. It furnishes twigs to the skin of the lower part of the leg and dorsum of the foot; and terminates by dorsal branches to the outer side of the fourth, and to the three inner toes.

3. *Deep* (N. peroneus profundus, muscularis), is continued forwards above the former nerve between the muscles, and divides into—

a. *Recurrent branch* distributed to parts about the knee-joint.

β. *Muscular branches* to the tibialis anticus, extensor longus digitorum, extensor proprius pollicis, and peronei muscles.

γ. *Anterior tibial branch,* descends with the anterior tibial artery, before which it is placed, upon the dorsum of the foot, and divides into branches to the skin, to the extensor brevis digitorum, and interossei muscles, one twig passing into the sole of the foot.

TIBIAL (N. tibialis). The inner and more considerable branch of the ischiadic, is sometimes, though improperly called, the popliteal nerve, while in the ham. It descends along the edge of the semi-membranosus in the ham, and is situated more superficially than the vessels. It then becomes more deep-seated, passes between the heads of the gastrocnemius, and continues its course through the leg between the superficial and deep-seated layer of muscles, accompanied by the posterior tibial artery, to the inner side of which it is placed. It is continued with the artery behind the inner malleolus, and in the hollow of the os calcis terminates by dividing into the *inner* and *outer plantar* nerves. It gives off in its course;—

1. *Communicating cutaneous branch* (N. cutaneus tibialis, communicans tibiæ), which is sometimes a branch of the peroneal or ischiadic. It descends between the gastrocnemius and skin in the course of the saphæna minor. At the lower part of the leg it is connected with the cutaneous branch of the peroneal, and is then continued behind the outer ankle and along the outer side of the foot, as far as the little toe, distributing in its course twigs to the skin.

2. *Branches* to the gastrocnemius, soleus, plantaris, and popliteus muscle.

3. *Branches* to the tibialis posticus, flexor longus digitorum, and flexor longus pollicis muscle.

4. *Cutaneous branch* (N. cutaneus plantaris). Distributed to the skin about the inner malleolus, and to that of the back part of the sole of the foot.

INNER PLANTAR (N. plantaris internus). Commonly more considerable than the outer. It passes forward above the adductor pollicis, along the tendon of the flexor longus, and after giving off branches to the muscles of the great toe, to the flexor brevis digitorum, the flexor accessorius, and to the lumbricales, divides into four *plantar digital* branches.

1. *First plantar digital,* which is continued along the inner side of the great toe to its tip.

2. *Second,* continued to the interstice between

the first or great toe and the second toe, where it divides into one branch which passes along the outer side of the great toe, and another which takes its course along the inner side of the second toe.

3. *Third,* which passes to the interstice between the second and third toe, where it divides to these toes in the same manner as the former.

4. *Fourth,* which divides to supply the third and fourth toe in like manner.

OUTER PLANTAR (N. plantaris externus). Takes its course outward and forward with the artery of the same name, between the flexor brevis and flexor accessorius; and after giving off twigs to these muscles and to the skin, divides into three branches, two *plantar digital* and one *deep* branch:

1. *Fourth plantar digital,* divides at the interstice between the fourth and fifth toes into two branches, one of which is continued along the outer side of the fourth, and the other along the inner side of the fifth toe, to their extremity.

2. *Fifth,* passes along the outer side of the foot, and after giving off twigs to the abductor of the fifth toe, is continued to its extremity.

3. *Deep,* passes obliquely inwards and forwards, deep-seated between the tendons of the flexor longus digitorum and the interossei. It gives off twigs to the interossei, transversalis, lumbricales, to the muscles of the little toe, and to those of the great toe.

§ 6. SYMPATHETIC NERVE.

(N. gangliosus, sympatheticus, intercostalis, systema gangliorum, systema vitæ automaticæ). This nerve is so essentially distinguished from the other nerves of the body, that it may be described separately, or as a separate system of nerves.

It consists of a considerable number of ganglia, of which the number and size differ not only in different individuals, but in the same individual on the two sides of the body; and of branches which in part connect these ganglia, or form junctions with the other nerves, and are in part distributed to the internal organs. It extends from the base of the skull, on each side of the vertebral column, through the neck, chest and abdomen, as far as the coccyx, forming, from above to below, numerous ganglia; these in the neck are few in number, but in the rest of its course it generally forms one ganglion between every two vertebræ; these are severally connected by one or more filaments with each other, and with all the nerves of the spinal marrow; and the uppermost cervical ganglion is connected with most of the cerebral nerves. Lastly, it detaches filaments to the viscera, and those which are distributed in the abdomen form connexions with a numerous set of ganglia in this cavity which are placed about the trunks of the large vessels.

The ganglia and their branches on each side of the spine will be first described, and afterwards those of the abdomen. In tracing the sympathetic nerve from above downwards from the base of the skull by the side of the vertebral column, the description will be most conveniently begun by the

1. CERVICAL GANGLIA:

1. SUPERIOR CERVICAL GANGLION (Ganglion cervicale supremum, fusiforme). Is one of the most considerable. It is situated behind the internal carotid artery, and before the transverse processes of the second and third cervical vertebra, and the rectus capitis internus major muscle. On the inner side are situated the pneumo-gastric and lingual nerves, with which it is connected by dense cellular membrane. Its form and size are subject to considerable varieties; it is most commonly of a spindle-like shape, but sometimes has different contractions; its length is usually not more than that of the second and third vertebra, but it sometimes reaches lower, and occasionally as far as the sixth cervical vertebra, varying in breadth and thickness. Various branches pass off from its circumference; they may be divided into superior, inferior, external and anterior.

1. *Superior*, generally a single branch, which takes its course through the carotid canal to join with branches of the cerebral nerves. It is situated behind the artery, and in its course divides into two branches, which continue their course through the canal, somewhat separated from each other. Whilst still within it one of the branches joins with a branch sent off from the external oculo-muscular where passing through the cavernous sinus; sometimes the branch of communication is double; and sometimes there is a ganglion (ganglion cavernosum) at the point of the union. The other branch of the sympathetic joins with the recurrent branch of the second division of the fifth pair, or the Vidian nerve. [Some anatomists describe small branches also which pass from the cavernous ganglion to the fifth pair or its divisions: and of late filaments have been described by Cloquet and Bock, which, continued from the above-mentioned ganglion with the ophthalmic artery, join with the lenticular ganglion; so that this ganglion is considered as belonging to the sympathetic. Indeed, Cloquet considers the ganglion-like en-

largements of the spheno-palatine and lingual branches of the fifth pair as parts of the sympathetic, and the Vidian nerve as forming the connexion between them and the cavernous and superior cervical ganglia; namely, by means of its superficial branch (which is continued as corda tympani) with the maxillary ganglion of the lingual, and by means of its deep branch with the spheno-palatine ganglion.]

2. *External branches:* are four in number, which sometimes come off by a single trunk. They pass over the rectus major internus. The two upper join with the arch formed by the connexion of the sub-occipital and first cervical nerves; the third joins with that formed by the second and third cervical nerves: the fourth, given off sometimes below the ganglion, joins with the arch of connexion between the third and fourth cervical, and detaches twigs to the rectus capitis major internus, and scalenus anticus.

3. *Anterior branches.* They are the most considerable in size and number, and from their softer texture are called commonly the *nervi molles.* The upper and shorter ascend to join with the lingual, pneumo-gastric, and facial, nerves, soon after they issue from the cranium. The inferior and larger pass downward and forward, and form a plexus of filaments which join with branches of the pneumo-gastric, and surround the divisions of the carotid, as well as the common carotid itself, as far as its origin. The most considerable of the anterior branches is the

α. Superficial cardiac (N. cardiacus superficialis, superior), which is formed by several filaments from the fore part of the ganglion, or from the sympathetic below it. A slender nerve is thus formed, which descends on the outer side of the common carotid, before the sympathetic; it gives some twigs to the pharynx, œsophagus, thyroid gland, and adjacent muscles, one or two of which are connected with branches of the pneumo-gastric, and terminates by branches which join with branches of the recurrent laryngeal. On the left side it reaches lower, and joins with the other cardiac nerves.

4. *Inferior branch* may be considered as the continuation of the trunk of the sympathetic. It varies in size and length. It descends on the rectus capitis internus major and longus colli muscle, at first behind the internal carotid, then behind and to the outer side of the common carotid artery; and sometimes divides inferiorly into two branches. It detaches twigs which join with the accessory and upper cervical nerves, and with the superficial cardiac and pneumo-gastric nerve; and terminates in the—

2. MIDDLE CERVICAL GANGLION (Ganglion cervicale medium). Is situated near the inferior thyroideal artery, between the sixth and seventh cervical vertebra upon the longus colli. It is not so constant as the superior, but is found in the greater number of instances. It varies in shape, is sometimes very small, and occasionally double. It sends off:

1. *External branches* which join with the inferior cervical nerves, commonly with the fourth, fifth, sixth and seventh.

2. *Internal branches* which accompany the thyroideal artery, and join with the recurrent laryngeal.

3. *Anterior branches*, five or six in number, forming the *deep cardiac nerve* (N. cardiacus magnus, profundus, medius). This descends inwards, at first along the common carotid, then upon the subclavian artery, is connected by several filaments with the pneumo-gastric, and joins with the third cardiac nerve to form the cardiac plexus. The *right* descends from the subclavian along the unnamed artery, where that vessel divides, joins by means of a ganglion with one or two branches of the pneumo-gastric, and then passes between the arch of the aorta and the bifurcation of the trachea. The *left* joins with one or two branches from the inferior cervical ganglion, (so that the middle and inferior cardiac branches which are separate on the right side are joined on the left,) then passes behind the arch of the aorta, is connected by filaments with the pneumo-gastric, and unites with the right cardiac branches to form the cardiac plexus.

4. *Inferior branches*. Form the continuation of the sympathetic; they are five or six in number. They descend on the right side before and behind the subclavian artery, and on the left side before and behind the aorta, to join with the inferior cervical ganglion. Sometimes there is only one short trunk which connects the middle with the inferior cervical ganglion.

3. INFERIOR CERVICAL GANGLION. Is more constantly found than the middle. It varies in size and figure; but is commonly of an irregular form. It is situated before the transverse process of the seventh cervical vertebra and the neck of the first rib. It sends off:—

1. *External branches*, which are small. They surround the subclavian artery, and are connected with the undermost cervical and first dorsal nerve.

2. *Internal branches*, which join with the filaments forming the pulmonary plexus.

3. *Anterior*. Form the *inferior* or *lesser cardiac nerve* (N. cardiacus inferior, tertius, parvus), which is commonly

only found on the right side. It takes its course behind the subclavian artery, then before the unnamed trunk to the arch of the aorta; is connected by filaments with the pneumo-gastric, passes between the aorta and pulmonary artery, and joins the cardiac plexus.

The *Cardiac Plexus* is formed by the cardiac branches abovementioned, but principally by the deep cardiac nerves; is situated between the arch of the aorta and the bifurcation of the trachea. It sends filaments to the aorta and to the pulmonary plexus, but the principal part forms the *coronary plexuses* (Pl. coronarii). The left and more considerable plexus passes over the left pulmonary artery, and is distributed with the left coronary artery. The right passes between the aorta and pulmonary artery, and accompanies the right coronary artery and its divisions.

THORACIC GANGLIA. In the cavity of the thorax the sympathetic forms between the transverse processes of each two vertebræ a ganglion called thoracic (Gangl. thoracicum, dorsale), of an irregular and variable figure. They are not all of the same size, and often the middle are smaller than those above and below; the uppermost thoracic ganglion is the largest. These ganglia are all connected with each other by considerable single branches; and with the corresponding dorsal nerves, by double filaments. From the superior ganglion small filaments are detached to the cardiac plexus and pulmonary plexus. The inferior form the splanchnic branches.

1. SPLANCHNIC (N. splanchnicus). Is formed commonly by filaments from all the ganglia between the fifth or sixth and the eleventh; but the number of its roots varies from three to seven. These unite to form a single trunk near the diaphragm. The splanchnic passes then through the lesser muscle of the diaphragm into the abdomen, and terminates in the semilunar ganglion, or in some of the ganglia connected with it. Not unfrequently one or more of the inferior roots pass separately to the semilunar ganglion, or join with some of the abdominal plexuses.

2. LESSER SPLANCHNIC (N. splanchnicus minor). The two or three undermost roots of the splanchnic not unfrequently join to form this separate smaller trunk, which passes through the lesser muscle of the diaphragm, is joined by filaments from the upper lumbar ganglia, and terminates principally in the renal plexus.

LUMBAR GANGLIA. Are situated on the lumbar vertebræ, and are placed more forwards than the dorsal. They are of an irregular figure, much smaller than the dorsal, are placed farther from each other, and are more variable in their situation. They become smaller from above to below, so that frequently the undermost are not distinct, or are wanting. They are connected with each other by slender filaments, which vary in size and in number. Each also is connected by slender filaments with the corresponding lumbar nerve; and filaments are sent inwards to join with the aortic plexus.

SACRAL GANGLIA. They are generally four or five in number, and are placed in a row which converges from above to below. The last is situated between the sacrum and the os coccygis, and is united with the opposite by a short slender filament. They are connected with each other, as well as with the last lumbar ganglion, by slender filaments, and by similar threads with the sacral nerves; and they send filaments to assist in forming the hypogastric plexus.

SEMILUNAR AND CŒLIAC GANGLIA, AND SOLAR PLEXUS (plexus solaris, semilunaris, abdominalis, ganglion semilunare). Form the centre from which nerves are distributed to the viscera contained within the abdomen. They are situated before the abdominal aorta, behind the peritonæum, between the renal capsules, and surround the trunk of the cœliac artery. There are commonly two considerable ganglia, called the *semilunar* from their figure, situated on each side, which are about an inch in length, and of considerable breadth and thickness. The right is commonly larger than the left, and is situated between the vena cava inferior, and the right crus of the diaphragm, contiguous to the right renal artery. The left is placed between the left crus of the diaphragm, and left renal capsule, near the pancreas. These are connected by numerous filaments, which pass transversely between their inner edges, dividing and joining in their course. About these principal ganglia, between the cœliac and superior mesenteric arteries, are several smaller ganglia called the *cœliac*, connected with the semilunar, and with each other by cross filaments, from which numerous other filaments pass off: all these filaments form together an intricate web which has been termed the *solar plexus*.

Sometimes the semilunar ganglia are divided into several smaller ganglia, connected by numerous small filaments.

From the solar plexus numerous filaments are continued with the principal arteries, forming junctions with each other, and intermixed with cellular substance. Each of these sets of filaments is called a plexus, and a name is given to each, descriptive of its course or distribution. The plexuses are :—

1. Hepatic Plexus (Pl. hepaticus). Passes downwards and to the right, accompanies the hepatic artery, and divides into a right and left plexus, which take the course of the divisions of the artery and penetrate the corresponding lobes of the liver. They are joined by filaments from the right pneumo-gastric. It detaches filaments, which form the—

α. *Inferior stomachic plexus,* which is continued with the right inferior gastric artery along the greater curvature of the stomach.

β. *Filaments* to the pylorus, duodenum, and pancreas, accompanying the arteries to these parts.

2. Splenic Plexus (Pl. splenicus). Consists of filaments which accompany and surround the splenic artery, along the pancreas. It furnishes filaments to the pancreas and stomach, and passes then with branches of the splenic artery into the spleen.

3. Superior Mesenteric Plexus (Pl. mesentericus superior). Is formed by filaments from the under part of the semilunar ganglia, and from the hepatic and splenic plexus. It accompanies the trunk and branches of the superior mesenteric artery, and is distributed to the small and a part of the large intestines, and to the pancreas.

4. Renal Plexus (Pl. renalis). Formed by five or six filaments from the upper and lateral part of the semilunar ganglion on each side, and increased by filaments from the superior mesenteric plexus. It accompanies the renal artery, is intermixed with small ganglia, and distributes its filaments to the kidney and renal capsule. This plexus is connected by filaments with the inferior thoracic and superior lumbar ganglia.

5. Spermatic Plexus (Pl. spermaticus). Is formed by filaments from the renal plexus, joined by others from the superior mesenteric plexus. It descends with the spermatic vessels, furnishes filaments to the ureter, and is continued in the male to the testicle, and in the female to the ovary.

6. Aortic Plexus (Pl. aorticus). Is formed by filaments, which are continued from the superior mesenteric plexus along the aorta, joined by branches from the lumbar ganglia.

7. Inferior Mesenteric Plexus (Pl. mesentericus inferior). Is formed by filaments continued from the last mentioned plexus, which, intermixed with ganglia, accompany and form a web about the inferior mesenteric artery; and are distributed to part of the colon and to the rectum.

8. Hypogastric Plexus (Pl. hypogastricus). The filaments from the aortic plexus descending into the pelvis, and joined by filaments from the lumbar and sacral ganglia, and from their connecting branches, form this plexus. It accompanies the pelvic vessels, and distributes twigs to the rectum and bladder; in the male to the prostate gland and vesiculæ seminales, and in the female to the uterus and to the vagina.

§ 7. TABLE OF THE NERVES.

I. Nerves from the Brain.

1. Olfactory. Dividing into—
   Branches to the Schneiderian membrane.

2. Optic. Forms the retina.

3. Common Oculo-muscular. Its branches are:—

    1. To the levator oculi and levator palpebræ superioris.
    2. Branch to the musc. adductor oculi.
    3. Branch to the musc. depressor oculi.
    4. Branch to the musc. obliquus inferior oculi.
    5. Branch to the lenticular ganglion.
        From the lenticular ganglion are given off:—
            Ciliary nerves.

4. Inner Oculo-muscular. To the obliquus superior oculi.

5. Trigeminal. Forms the semilunar ganglion, and is divided into three branches, viz.

    a. Ophthalmic. Its branches are:—
        1. Supra orbitar.
        2. Nasal, giving off—
            α. Branch to the lenticular ganglion.
            β. Ethmoidal.
        3. Lacrymal.

b. Superior Maxillary. Its branches are:—
   1. Malar.
   2. Spheno-palatine.
   3. Pterygoid, giving off:—
      α. Superficial, joining with the facial nerve.
      β. Deep, joining with the sympathetic nerve.
   4. Palatine.
   5. Alveolar.
   6. Infra-orbitar.

c. Inferior Maxillary. Its branches are:—
   1. Deep temporal.
   2. Masseterine.
   3. Buccal.
   4. Pterygoid.
   5. Temporal.
   6. Dental.
   7. Lingual.

6. Outer Oculo-muscular. To the musc. abductor oculi, and gives off:—
   Branches which join with the sympathetic.

7. Auditory. To the membrane of the labyrinth of the ear.

8. Facial. Its branches are:—
   1. Chorda tympani.
   2. To the auricle and parts about the angle of the jaw.
   3. Temporal.
   4. Superior facial.
   5. Middle facial.
   6. Inferior facial.
   7. Descending.

9. Glosso-pharyngeal. To the pharynx and tongue.

8. Pneumo-gastric. Its branches are:
   1. Pharyngeal.
   2. Laryngeal, divides into—
      α. External branch.
      β. Internal branch.
   3. Filaments passing upon the carotid artery.
   4. Cardiac.
   5. Recurrent.
   6. Pulmonary.

7. Œsophageal.
8. Coronary of the stomach.

9. **Lingual.** Its branches are :—
    1. Descending.
    2. To the tongue and its muscles.

II. Nerves from the Spinal Marrow.

Consisting of thirty-one pairs.

Accessory.
Sub-occipital.

Cervical Nerves.

Consist of seven pair, viz.—

First Cervical. Its branches are :
    1. Anterior, forming branches of communication.
    2. Occipital.

Second Cervical. Its branches are :
    1. Anterior, dividing into—
        α. Superficial of the neck.
        β. Small occipital.
    2. Posterior, forming branches of communication.

Third Cervical. Its branches are
    1. Anterior.
    2. Posterior.

Diaphragmatic Nerve. Formed by branches from the second, third, and fourth, cervical nerves.

Fourth Cervical
Fifth
Sixth
Seventh
First Dorsal
} form the axillary plexus.

Branches from the Axillary Plexus :—

1. **Thoracic.**
2. **Scapular.**
3. **Articular.**
4. **Inner Cutaneous.**
5. **Inner Small Cutaneous.**
6. **Outer Cutaneous.**

7. RADIAL. Its branches are :—
    1. To latissimus dorsi and triceps muscle.
    2. Cutaneous.
    3. To supinator longus and extensors.
    4. Superficial, giving off :—
        α. Palmar.
        β. Dorsal.
    5. Deep branch.

8. MEDIAN. Its branches are :—
    1. To pronator teres, and the flexors of the hand.
    2. Interosseous.
    3. Palmar.
    4. To the thumb and fore finger.
    5. To the fore and middle finger.
    6. To the middle and ring-finger.

9. ULNAR. Its branches are :—
    1. To the flexors of the hand and fingers.
    2. Cutaneous.
    3. Dorsal.
    4. Superficial palmar, giving off :—
        α. Branches to muscles of little finger.
        β. Branch to little finger.
        γ. Branch to ring and little finger.
    5. Deep palmar.

THORACIC NERVES.

Consist of twelve pair. Their branches are :—
1. POSTERIOR, to the muscles near the spine.
2. ANTERIOR, to the intercostal muscles, &c.
3. INTERCOSTO-HUMERALES, from the second and third.

LUMBAR AND SACRAL NERVES.

Both consist of five pairs which communicate and form the crural plexus. Their branches are :—
1. DORSAL, to the muscles near the spine and sacrum.
2. EXTERNAL SPERMATIC, from the first and second lumbar.
3. BRANCHES to the psoas, quadratus, &c. from the first and second lumbar.

4. **External Cutaneous,** from the third lumbar.
5. **Superior Gluteal,** from the fourth and fifth lumbar.
6. **Inferior Gluteal,** from the second and third sacral.
7. **Common Pudic,** from the fourth and fifth lumbar, and from the three uppermost sacral. It divides into :—
    1. Superior branch, forming dorsal of the penis, or the nerve of the clitoris.
    2. Inferior to perineum, rectum, &c.

8. **Branch** to the rectum, organs of generation, &c. from the third, fourth, and fifth sacral.
9. **Obturator,** from the second, third, and fourth lumbar.
10. **Crural,** from the four upper lumbar, giving off :—
    1. Superior cutaneous.
    2. Muscular branches.
    3. Inferior cutaneous.

11. **Ischiadic,** from the fourth and fifth lumbar, and from the three uppermost sacral, giving off :—
    1. Twigs to obturator internus, quadratus; &c.
    2. Branch to gluteus maximus.
    3. Branch to biceps, semi-tendinosus, semi-membranosus.
    4. Superior cutaneous.
    5. Inferior cutaneous.

Ischiadic Nerve divides into peroneal and tibial.

Peroneal, its branches are :—
1. Cutaneous.
2. Superficial.
3. Deep branch, giving off—
    - α. Recurrent.
    - β. Muscular branches.
    - γ. Anterior tibial.

Tibial, giving off :—
1. Communicating cutaneous.
2. Branches to gastrocnemii muscles, &c.
3. Branches to the deep-seated muscles of the leg.
4. Cutaneous.

Tibial Nerve, divides into inner and outer plantar.

INNER PLANTAR, its branches are :—

1. Plantar digital, viz.
    - α. First to great toe.
    - β. Second to great toe and second toe.
    - γ. Fourth to third and fourth toe.
    - δ. Third to second and third toe.

OUTER PLANTAR, its branches are :—

1. Plantar digital, viz.
    - α. Fifth to fourth and little toe.
    - β. Sixth to little toe.
2. Deep.

SYMPATHETIC NERVE.

Its ganglia, with the branches of the sympathetic connected with these, are :—

1. SUPERIOR CERVICAL GANGLION. Branches from it are :—
    1. Superior. Join with external oculo-muscular and Vidian branch of the trigeminal.
    2. External. Join with sub-occipital, and first, second, third, and fourth cervical.
    3. Anterior, consisting of
        - α. Superior. Join with lingual, pneumogastric, and facial.
        - β. Inferior.
        - γ. Superficial cardiac nerve.
    4. Inferior.
2. MIDDLE CERVICAL GANGLION. Branches from it are :—
    1. External. Join with fourth, fifth, sixth, and seventh cervical.
    2. Internal. Join with recurrent laryngeal.
    3. Anterior. Form deep cardiac nerve.
    4. Inferior.
3. INFERIOR CERVICAL GANGLION. Branches from it are:—
    1. External. Join with undermost cervical and first dorsal.

2. Internal. Join with nerves of pulmonary plexus.
3. Anterior. Form small cardiac nerve.

4. THORACIC GANGLIA. Branches from them are:—
   1. Branches of connexion with each other.
   2. Branches of connexion with dorsal nerves.
   3. Branches from the first thoracic ganglion, connected with the pulmonary and cardiac plexus.
   4. Splanchnic, formed by filaments from the sixth, seventh, eighth, ninth, and tenth.
   5. Lesser splanchnic.

5. LUMBAR GANGLIA. Branches from them are:—
   1. Branches of connexion with each other and last dorsal.
   2. Branches of connexion with lumbar nerves.
   3. Branches of connexion with aortic plexus.

6. SACRAL GANGLIA. Branches from them are:—
   1. Branches of connexion with each other and with the last lumbar nerve.
   2. Branches of connexion with sacral nerves.
   3. Branches to hypogastric plexus.

7. SEMILUNAR AND CŒLIAC GANGLIA, forming solar plexus, from which are derived:
   1. Hepatic plexus, giving off:—
      - α. Inferior stomachic plexus.
      - β. Filaments to pylorus, duodenum, pancreas.
   2. Splenic plexus.
   3. Superior mesenteric plexus.
   4. Renal plexus.
   5. Spermatic plexus.
   6. Aortic plexus.
   7. Inferior mesenteric plexus.
   8. Hypogastric plexus.

THE DISSECTOR'S MANUAL.

Section the Fourth,

CONTAINING THE

DISSECTION OF THE ORGANS OF THE SENSES AND OF THE VOICE, AND OF PARTS CONNECTED WITH SURGICAL PRACTICE.

SECTION THE FOURTH,

CONTAINING THE DISSECTION OF THE

ORGANS OF THE SENSES AND OF THE VOICE,

AND OF

PARTS CONNECTED WITH SURGICAL PRACTICE.

CHAPTER I.

Of some Parts about the Head and Neck.

§ 1. LATERAL PARTS OF THE NECK.

A THIN layer of pale muscular fibres, called the platysma myoides, spreads out upon and covers the whole of the lateral parts of the neck. These fibres run obliquely parallel, extending some way above the inferior maxilla and below the clavicle. Under them, and filling their interstices, there is a tough membranous substance, particularly described by late anatomists under the names of aponeurosis, superficial fascia, or condensed cellular membrane. It seems, indeed, to exist, more or less, in all parts of the body, and to be nothing more than the common reticular membrane, which is locally stronger and thicker, from original conformation, motion or pressure, and for the purposes of support or resistance. It will, probably, be found strongest in those who have become thin after a state of obesity. A knowledge of it has justly been deemed important in explaining the progress and growth of tumours, the course and burrowing of pus, &c.

The sides of the neck deserve particular notice, not only from their vicinity to important organs, but as themselves containing numerous vessels and nerves, intricately disposed: and which, embedded in cellular membrane, are received in hollows between the muscles and more solid parts. Such excavations, and for similar uses, are found throughout the body. Thus in the extremities, the larger vessels and nerves are placed in the bend of the joints; where, surrounded by fat in a loose cellular membrane, no hinderance is offered to the respective functions of these essential and delicate parts, even under strong and continued muscular action. To the Surgeon, therefore, the accurate knowledge of the situation, form, extent, and contents of these, is especially interesting.

The *side of the neck* comprehends a hollow space, bounded behind and to the outer side by the spine, by the muscles attached to it, and the muscles of the back of the neck; before, by the air-tube and its appendages; above, by the inferior maxilla, the cranium, and the parts attached to these; below, by the clavicle and upper part of the chest. It is divided into *two triangular spaces* by the sterno-cleido-mastoideus muscle in its oblique course between its attachments.

LOWER SPACE. The lower space is comprehended between the clavicle, the outer edge of the sterno-mastoid muscle, and the outer edge of the trapezius muscle. In the bed formed by these, bounded behind by parts of the spine and muscles attached to them, and by the upper part of the chest below, are lodged the nerves and vessels that supply the upper extremity. This *space* is diminished in height and increased in depth by the elevation of the clavicle; therefore by the depression of the clavicle the parts situated within are brought nearer to the surface, whilst the space itself is rendered longer.

Before the dissection, the arm should be depressed as much as possible, in order to bring down the clavicle. To display the parts, we must turn back a triangular flap of integuments, corresponding to the figure of the space, and made by carrying one incision along the outer edge of the sterno-mastoid muscle, and another to meet it along the upper edge of the clavicle. The fibres of the *platysma myoides* and of the *aponeurosis* are to be turned back in the same way; when processes of the latter will be seen to dip in between the contained parts. The bed of *cellular membrane* next presents itself. This is to be removed, dissecting out with care the several larger *cutaneous veins, branches of arteries*, and *twigs of nerves*; the last coming from the cervical nerves. The *external jugular vein* crosses obliquely the sterno-mastoid and this space, terminating behind the clavicle in the subclavian vein. Continuing the dissection behind the level of the sterno-mastoid, several *absorbent glands* will be found, as also at the outer edge of the last named muscle, in the neighbourhood of the axillary plexus. The *omo-hyoideus muscle* traverses the space obliquely, and passes behind the sterno-mastoid; a line, drawn from a point on this muscle, about two inches above the sternum, to the junction of the clavicle with the scapula, marks its course. The *scalenus anticus* and *medius muscles* are deeply seated behind, and a little to the outer side of, the sterno-mastoid. From between these, behind the omo-hyoideus, the *four inferior cervical* and *first dorsal nerve* pass outwards and downwards to between the subclavius muscle and first rib, and form the axillary plexus: two or three of these are situated above the omo-hyoideus. The *subclavian vein* is seated behind the sternal portion of the clavicle; it passes outwards and downwards from before the scalenus anticus behind the clavicle. Somewhat above it, and more posteriorly from the intervention of the scalenus anticus muscles, is the *subclavian artery*, the large arterial trunk which supplies the shoulder and upper extremity. In examining the relative position of this artery on the right and on the left side, some difference will be found before they reach the scaleni, caused principally by the difference of origin.

The description of the subclavian arteries has been already given, p. 208. We have seen, that they pass transversely between these muscles, are inclined downward and outwards, between the axillary plexus and clavicle, pass the latter at an acute angle, being covered by it and the subclavius muscle, and change their name to that of the axillary arteries. In the space between the scaleni and clavicle they have behind them, and to their outer side, the nerves of the axillary plexus; and to the inner side, the first rib. Upon the first rib, and before they have passed it, they are immediately adjacent to the pleura, as it rises somewhat above the level of the rib.

The *cervical arteries*, with some of their branches, are commonly seen in this space.

The more important *points of practice* to which the parts contained in this space have reference, are the following:—Compression of the subclavian artery, so as to prevent the flow of blood to the upper extremity.—Aneurismal tumours of the subclavian artery.—The operation of taking up the subclavian artery.—The opening of the external jugular vein.—Exostoses from the vertebræ.—The progress, symptoms, and extirpation of glandular and other tumours.

UPPER SPACE. The upper space of the side of the neck is anterior to the sterno-mastoid muscle, and, like the lower space, of a triangular form. It is circumscribed: above, by the lower jaw and parotid gland; before, by the muscles attached to the os hyoides; behind, by the inner edge of the sterno-mastoid muscle. It is deepened by the projection of the larynx and trachea, and extends likewise behind the lower jaw. In order not to lay bare too many parts at once, this division of the neck may be conveniently *subdivided into two parts* by a line drawn horizontally from the os hyoides [where the common carotid divides into the external and internal carotid arteries] to a corresponding point on the sterno-cleido-mastoideus.

LOWER SUBDIVISION OF THE UPPER SPACE.

The lower subdivision contains the common carotid artery, in its ascent to the head, as it passes by the side of the air-tube, accompanied by the internal jugular vein.

The contained parts may be displayed by making one incision, through the skin, platysma myoides, and aponeurosis, along the inner edge of the sterno-mastoid, and another to meet its upper extremity in the direction of the line which forms the upper boundary of this subdivision: then turning back this triangular flap and dissecting away the cellular membrane. The *omo-hyoideus* will be seen continued from behind the sterno-mastoid and crossing it nearly opposite to the upper margin of the cricoid cartilage. The point of decussation may be ascertained by stretching a thread between the anterior part of the mastoid process of the temporal bone and the centre of the upper bone of the sternum, and thus marking the course of the inner edge of the sterno-cleido-mastoideus: and another shewing the direction of the omo-hyoideus, between the side of the body of the os hyoides and the centre [nearly] of the clavicle. Behind the point of intersection the common carotid is commonly placed. Next to the omo-hyoideus is the *sterno-hyoideus;* but more anteriorly, inferiorly, and less oblique. To these muscles small twigs are given off from the *descendens noni,* a nerve which descends superficially on the common carotid, and said to be sometimes inclosed within the sheath of this artery. This nerve is united to twigs from the upper cervical nerves, and is ultimately distributed to the above-mentioned muscles and the sterno-thyroideus. Of *the common carotid artery* a small portion [only about an inch] is seen where rising above the omo-hyoideus, and corresponding to the edge of the sterno-mastoid muscle, it being covered, below, by the omo- and sterno-hyoidei; on the outer side, the *internal jugular vein,* and the *nervus vagus* situated between it and the carotid, take their course: the nerve, the vein, and the artery, are inclosed within a common sheath of cellular membrane.

Behind the jugular vein, but exterior to the sheath, is placed the *sympathetic nerve.* In the course of the carotid is a chain of *absorbent glands,* (glandulæ concatenatæ) which receive lymphatics from the head and neck.

A small nerve, (the nervus superficialis cardiacus) formed from the superior cervical ganglion and internal laryngeal nerve, passes along the inner edge of the carotid.

Practical Points. Aneurism of the carotid artery.—The operation of securing the carotid artery.—Bronchocele (extent of)—Glandular and other tumours.

SPACE BEHIND THE STERNO-MASTOID MUSCLE. In order to gain a view of the situation, course, and connexion of the carotid and subclavian arteries nearer the trunk, as well as their relation to other important parts, the dissection may be prosecuted by raising cautiously the attachment of the sterno-mastoid muscle to the clavicle and sternum. In the narrow space behind this muscle the subclavian artery, previously to its passage between the scaleni muscles, is connected with the nervus vagus, the recurrent laryngeal, the sympathetic and phrenic nerve, and the subclavian vein; and on the left with the termination of the thoracic duct, the carotid artery and the internal jugular vein.

The course and relative position of the *subclavian artery* have been already spoken of in the description of the lower space of the side of the neck. And here (in the space, namely, behind the sterno-mastoid) after a course of about an inch, it will be seen passing behind the scalenus anticus muscle. At the edge of that muscle it detaches *the cervical arteries:* the inferior thyroideal artery passing upwards and inwards behind the carotid artery, and branches of the anterior cervical in the space above the clavicle. The subclavian artery, at its origin, is crossed anteriorly, behind the sternal extremity of the clavicle, by the *nervus vagus.* That nerve, in its passage before the artery, gives off *the recurrent laryngeal nerve;* which, on the right side, hooks round the subclavian artery, but on the left passes around the arch of the aorta, and then takes its course upwards and inwards by the side of the sympathetic nerve, to the posterior and lateral parts of the trachea. Opposite to the nervus vagus, but behind the subclavian, is the *sympathetic nerve,* with its *lower cervical ganglion.* The *subclavian vein* lies anterior to the artery, but in its collapsed state seeming lower; and passes the clavicle in a more horizontal direction, and nearer to its sternal extremity. The direction of the nerves forming the *axillary plexus* is more oblique than that of the artery, and their situation nearer to the scapula. The *internal jugular vein* accompanies the margin of the scalenus and joins with the subclavian vein below: and it is at this junction on the left side, that the *termination of the thoracic duct,* after coming from behind the jugular vein, may be traced. On the outer and fore part of the scalenus anticus, the *phrenic nerve* is placed, which continues its course into the thorax between the subclavian artery and vein.

The removal of the omo-hyoidei, sterno-thyroidei, and sterno-hyoidei, displays the course of *the common carotids* at the root of the neck. (*See* p. 199).

Practical points. Projection of aneurismal tumours from the arch of the aorta, or arteria innominata.—Practicability of passing a ligature around the arteria innominata. Necessity of particular attention to these parts in the operation for the wry neck.

UPPER SUBDIVISION OF THE UPPER SPACE.

Of the lateral parts of the neck, the upper subdivision of the space, before the sterno-mastoid muscle, alone remains to be described. The parts which circumscribe it have been already spoken of; and that it is enlarged by its elongation upwards behind the lower jaw. It is bounded behind by the spine and muscles attached to it.

In describing the relative position of the contained parts, the basis of the cranium will be considered as horizontal. In this position the surface of the teeth in the upper jaw will be nearly in the same plane as the foramen magnum of the os occipitis. Between the vertebræ and internal surface of the lower jaw, together with the concavity of the roof of the mouth, sufficient space is left for the tongue, some large vessels, nerves, and important glands. Between the mastoid process of the temporal bone, and the ascending plate of the maxilla inferior, the meatus auditorius externus is placed. The ascending plate is about two inches in length, and the angle of the jaw about one inch anterior to the cervical vertebræ. A little before the root of the mastoid process, but nearer to the centre of the base of the skull, the styloid process begins; in the adult, in whom the lower jaw is furnished with teeth, its extremity is hidden by the ascending plate of the jaw-bone. In this position of parts, when the muscles are not in action, the pharynx is flattened; and the larynx rests on its posterior side, which is in contact with the vertebral column. The os hyoides is nearly as high as the lower margin of the jaw-bone; hence the posterior belly of the digastric muscle has only a slight declination, whilst the anterior runs straight forward.

On removing from this subdivision, the coverings (which it has in common with the rest of the neck), the inferior portion of the parotid gland will be seen to project below the inferior maxilla behind its angle, and to rest on the sterno-mastoid opposite that part. Near to the chin is the anterior belly of the *digastricus.* A small portion of the *submaxillary gland,* which is situated within the jaw, appears below it: the gland being lodged in a considerable cavity between the jaw-bone and the tongue, the roof of which, toward the chin, is formed by the mylo-hyoideus, and nearer to the angle of the jaw by the hyo-glossus, intersected by the stylo-glossus. In this position of the head, the submaxillary gland is almost entirely covered by the body of the jaw-bone; and is received between that bone and the two bellies of the digastric muscle. In this cavity, besides the submaxillary are lodged *absorbent* glands, as likewise the facial artery and vein, together with the branches sent off from them, before they mount on to the face. The facial *artery*, at its origin, is concealed by the jaw, passes under the stylo-hyoideus and tendon of the digastricus, and before its passage over the jaw is embedded in the substance of the submaxillary gland. The facial *vein* descends along the side of the gland nearest to the ear, generally about this part joining with the temporal vein, and with it forming the *external jugular vein.* Situated more under the anterior portion of the tongue between the mylo-hyoideus and genio-glossus is the *sublingual gland.*

By bending the head back, the relative situation of these parts is altered, particularly that of the submaxillary gland, and that of the facial artery and vein. By the elevation of the chin the cavity between the maxilla and mylo-hyoideus is reduced in size, and those parts, which in the usual position of the head lie retired behind the jaw, are exposed.

This position is favourable for the prosecution of the dissection, which may be continued by removing the inferior portion of the parotid gland, so as to lay bare the anterior margin of the sterno-mastoid and the posterior edge of the ascending plate of the jaw-bone; and thus the parts situated about the angle may then be conveniently examined. The posterior belly of the digastricus and the stylo-hyoideus muscle are seen extended obliquely towards the os hyoides. The disposition of the other parts may be displayed by commencing at the back part, and continuing the dissection forwards. An incision along the anterior margin of the upper extremity of the sterno-mastoid will expose the *nervus accessorius ad par octavum* between the transverse process of the atlas and the internal jugular vein; but lower down it is covered by the sterno-mastoid muscle which it perforates in its passage to the trapezius. Nearer to the angle of the jaw than the accessory nerve, but in contact with the latter, is the *internal jugular vein;* next to which is the *lingual nerve;* and then the *internal carotid artery,* which is deeper seated than the *external carotid.* The *lingual nerve* appears between the internal carotid and jugular vein, a little lower than the line of the lower jaw. At the origin of the occipital artery it turns forward and crosses over both carotids, and at this place sends off the *ramus descendens noni*; it continues its course behind the termination of the facial vein, but before the external carotid artery; nearer to the os hyoides it passes behind the digastricus and stylo-hyoideus, lying between them and the stylo-glossus. The lingual nerve is in contact with the *lingual artery*, until they reach the side of the tongue; but at that part the hyo-glossus muscle is interposed. As far as to the point where it reaches the junction of the cornu with the body of the os hyoides, the artery is covered by the skin, platysma myoides, aponeurosis, and the hyo-glossus muscle. We may therefore expose it by dividing these parts, guided by the cornu of the os hyoides. It then turns forward and divides into branches to the substance of the tongue. The branch, called the *ranina*, lies just above the attachment of the frænum of the tongue. The *occipital artery* arises generally from the external carotid, a little lower than the angle of the jaw; in its course it slants upwards and outwards, traversing the internal carotid, the nervus vagus, the lingual nerve, and the internal jugular vein; it then passes behind the digastric muscle, and around the root of the mastoid process just above the transverse process of the atlas. Above the hyo-glossus muscle the *gustatory nerve* (the lingual branch of the third division of the fifth pair of nerves) runs towards the tongue.

The *glosso-pharyngeal nerve* makes its appearance from between the carotids just at the origin of the stylo-pharyngeus, and as well as that muscle is sunk behind the jaw-bone.

Behind the cavity of the submaxillary gland, the *tonsil* lies deep-seated, sunk in the recess formed by the pillars of the fauces, situated in the angle between the stylo-glossus and stylo-pharyngeus, and covered by the palato-pharyngeus. The external carotid is nearly opposite to the tonsil, the internal a little behind it.

Practical points. Glandular and other tumours—in the operation for their removal the importance of attending to the parts behind the angle of the jaw—Ranula—Calculi in sublingual gland [removal of]—Puncturing the tonsil—Removal of the tonsil.

§ 2. FORE PART OF THE NECK.

On the fore part of the neck, there remain to be studied the relations of the larynx, trachea, and parts connected with them, between the diverging bellies of the sterno-mastoid muscles. Their situation may be ascertained, without removing their coverings: and therefore may and should be learnt in the living person. In the adult, when the base of the skull is placed horizontally, the *os hyoides* will be felt a little lower than the level of the edge of the jaw. Under it is the *thyroid cartilage* at some little distance, the part called the pomum adami with its notch distinctly projecting: Its prominent edge on the anterior part may be traced downwards, as it somewhat recedes. Below the thyroid is the *cricoid cartilage,* with a small intervening space betwixt them. The *transverse portion of the thyroid gland* may be generally next perceived by its soft inelastic feel. The trachea occupies the angular hollow formed by the approximation of the sterno-mastoid muscles above the upper bone of the sternum.

If the head be turned back, the relative situation of these parts will be altered, so that they are more separated from each other, and a larger portion of the trachea becomes situated in the neck. In this position the parts may be laid bare; but the dissection should be proceeded in with caution so as to shew the situation and extent of the *thyroid gland,* with its relation and connexion to the surrounding parts. Its two lobes will be seen placed at the under and lateral parts of the larynx, covered by the sterno-hyoidei, and sterno-thyroidei, descending a little way on the trachea and œsophagus, and connected by a cross portion on the fore and upper part of the trachea. The gland is supplied by the four *thyroideal arteries;* the two superior descending upon its upper margin from their origin at the beginning of the external carotid; the two inferior arising from the subclavian, and ascending on each to the inferior part of this gland. The *inferior thyroideal veins,* arising on the left from the subclavian vein, on the right from the superior cava, are placed on each side the trachea, but on its fore part form an arch from which branches pass off to the gland.

In the young subject, the relative distances of the parts situated between the chin and sternum differ from the adult structure. This difference is the result of the incomplete developement of the lower jaw and larynx. When the alveolar processes are not formed, and the ascending plate and angle of the inferior maxilla are not developed, the bifurcation of the carotid will be found at a greater distance from the angle, thus exposing the primary branches of the external carotid, which are concealed in a great measure in the adult by the lower jaw. Before the developement of the larynx, which does not take place in the male till puberty, and not all in the female, there will be proportionably a greater length of trachea, and hence a greater distance between the thyroid gland, and the sternum. The projection of the thymus gland above the sternum, is also a peculiarity of early age.

In old age, a new change from the structure of the adult as above described, takes place when the teeth fall out, and the alveolar processes become absorbed. The newly assumed position of parts approaches the character of infancy in these circumstances, but acquires a peculiar character from the unaltered length of the ascending plate of the jaw-bone. Thus in age, when the mouth is closed, the chin becomes raised and projected forwards, and the angle of the jaw removed from the mastoid process, in consequence of which the large vessels and nerves are more exposed. By bringing the jaws in contact, the mylo-hyoideus is put on the stretch, and the submaxillary gland becomes almost entirely protruded below the margin of the lower jaw: in this respect resembling the adult with the head thrown back.

Practical Points. The most advantageous part for the performance of bronchotomy—difficulties of the operation.—Extent and consequences of bronchocele.

§ 3. SIDE OF THE FACE.

Amongst the circumstances which demand attention on the side of the face, the superficial extent of the *parotid gland* may first be displayed. It reaches from the zygomatic arch downwards to below the angle of the jaw, covers a portion of the masseter, and occupies the space between the ascending plate of the jaw-bone and mastoid process. Embedded within the substance of the gland the *portio dura* of the seventh pair passes through it, and crosses the external carotid artery. Before we follow the deep-seated connexions of the parotid, the course of the portio dura should be traced. This, after quitting the foramen stylo-mastoideum, is directed downwards and forwards, and becomes situated in a hollow behind the parotid gland, continuing its course in an undivided trunk for about half an inch. At this part it may be cut down upon by beginning an incision at the root of the mastoid process, and continuing it along the anterior margin of the sterno-mastoid muscle. Then prosecuting the dissection, and cutting through a part of the glandular substance of the parotid, we shall find the nerve. During this operation, the arteria posterior auris and a branch of one of the cervical nerves to the ear will necessarily be divided. Soon after quitting the foramen stylo-mastoideum, the portio dura enters the parotid, and divides into branches which spread and are distributed to the face and throat. About midway between the ascending plate of the jaw-bone and the mastoid process it is opposite to the external carotid artery.

The attachments of the parotid gland may now be traced.—To understand its real extent it must be followed to the root of the meatus auditorius externus, where behind the angle of the jaw it adheres to the internal pterygoid muscle, is folded over the posterior edge of the masseter muscle, and lies deep-seated between the ascending plate of the jaw-bone and mastoid process. The *external carotid*, after passing up from behind the stylo-hyoideus and digastricus, is likewise buried in the substance of this gland; continuing its course upwards, and during its connexion with the parotid giving off the *posterior aural*, the *transverse facial*, and the *internal maxillary*, arteries. It is crossed within the gland by the portio dura about one inch above the angle of the jaw. Some *absorbent glands* are connected with the exterior of the parotid gland. The *duct of the parotid* arises from the anterior margin of the gland: its course may be marked generally by a line drawn from the junction of the lobe of the ear with the pinna to the base of the nose. It often receives a small duct from a corresponding glandular process situated above it on the masseter—the *glandula accessoria* of Haller, of the same structure as the parotid. The duct continues its course in the just described direction over the anterior margin of the masseter muscle, and enters a *hollow space*, which extends from the masseter, between the projecting part of the superior maxillary bone above, and the inferior maxilla below, to the corner of the mouth, the side of the nose, and the inner angle of the eye; the bottom of the cavity being formed by the buccinator muscle and upper jaw, and the space extending under the zygoma to the articulation of the lower jaw, between the buccinator muscle and upper jaw behind, and the masseter and lower jaw before. In this space the duct is lodged in a mass of fat, interposed between the masseter and buccinator, and perforates the latter, terminating in the mouth opposite to the second molar tooth. The duct is accompanied by the *arteria transversalis faciei*, which is given off from the external carotid whilst within the substance of the parotid, inclines upward and becomes situated between the parotid duct and zygoma. It is accompanied likewise by *branches from the portio dura*, the largest of which takes its course some little way above it. Near to its termination it is crossed by the *facial vein*; but the artery is inclined considerably nearer to the mouth, having quitted the vein after their passage over the lower jaw at the edge of the masseter. The *facial vein* is begun by the veins of the forehead; as it descends it is close to the tendon of the orbicularis palpebrarum; it then takes its course obliquely backwards as far as the anterior margin of the masseter muscle, having traversed the infra-orbitar nerve at its passage from the foramen of the same name. Along its whole extent the vein is nearer to the ear than the artery and at some distance from it, but during their passage over the inferior maxilla they run parallel and close together. Besides the termination of the parotid duct, and of the facial artery and vein, there are lodged, in the space above described, twigs of the facial and sub-orbitar nerves. The situation of the *infra orbitar nerve* may be ascertained by drawing a line from the internal angular process of the os frontis obliquely across the orbit to the centre of the os malæ, and another perpendicular with it nearly an inch from the inner angle of the eye; when the latter will cross the orifice of the sub-orbitar foramen a quarter of an inch below the inferior edge of the orbit.

The *dental nerve* issues from the mental foramen below the posterior bicuspides, and may be cut down upon by dividing the lining membrane of the mouth between the gum and muscles at this part. The *supra-orbitar branch of the ophthalmic nerve* may be found on the superciliary ridge about one inch from the nose outwards.

The *lacrymal sac* is situated about one eighth of an inch within the margin of the orbit behind the tendon of the orbicularis palpebrarum, being received into a groove formed by the os unguis behind and the nasal process of the superior maxillary bone before. The sac tapers and gradually forms the *nasal duct*, which opens under the inferior turbinated bone about half an inch behind the margin of the superior maxillary bone, where assisting in forming the nostril.

Practical points. In cases of tic douleureux, the division of the portio dura or its branches, of the supra-orbitar, dental or sub-orbitar, nerves.—Glandular tumours about the parotid gland.—Tumours in various situations, as, between the buccinator and masseter muscles, at the inner canthus of eye, connected with the parotid duct, &c.—Practicability of extirpating the parotid gland. Division of the parotid duct.—Obstruction of nasal duct—passing a probe into it.—Fistula lacrymalis, and operation for it.

CHAPTER II.

Of the Eye.

THE organ of vision, situated within the orbit, consists of the globe of the eye and its appendages.

§ 1. OF THE APPENDAGES.

The APPENDAGES are:—

EYEBROWS (Supercilia). Are slight eminences of the common integuments, somewhat arched in figure, placed on the superciliary ridges, and covered by short hairs, the roots of which are towards the nose, whilst their points are directed outwards.

EYELIDS (Palpebræ). The upper eye-lid begins from the eye-brow, is larger, and, when depressed, nearly covers the anterior part of the eye. The under and smaller eye-lid begins from the cheek. The eye-lids have the skin upon them furrowed. They are joined, and form angles at their extremities, distinguished by the names of *inner* and *outer canthus*. The lids are formed by a fold of common integument, which at this part is extremely thin. In each of them there is found a thin fibrous layer, approaching to cartilage, called the *tarsus*. The upper tarsus is broader than the lower, and they are both broader in the middle than at the extremities. They are closely united to the edges of the orbit, especially at the outer side, by an expanded *ligamentous substance*. To the inner side they terminate at a little distance from the inner angle, and are connected by the tendon of the orbicularis palpebrarum. At the edges of the eye-lids are placed several rows of stiff hairs, called the *cilia*, or eye-lashes. Those of the upper eye-lid are bent upwards, and are longer than those of the under eye-lid, which are bent in the opposite direction. In both they are wanting near the inner angle.

Between the tunica adnata which lines the eye-lids, and the tarsi, are placed a row of sebaceous follicles, called the *glandulæ* *tarsi*, or *Meibomii*. They appear like a series of parallel white lines, running in a serpentine direction, and some joined together. From the openings of these (puncta ciliaria) a sebaceous matter may be expressed, which is the secretion for the lubrication of the eye-lids.

TUNICA CONJUNCTIVA, or *Adnata*. Is a thin membrane, which, as its name implies, connects the globe with the eye-lids. It may be said to begin at the edge of the upper eye-lid, and to line it internally; it is then reflected upon the globe, covers its anterior surface, and passes upon the under eye-lid, terminating at its edge. Just behind the caruncula lacrymalis, in quitting the globe at the inner canthus, it forms a fold, sometimes scarcely marked, called the *valvula semilunaris*.

This membrane has apparently a similar texture with that of the mucous membranes; but it is so thin as to shew the parts underneath. It is connected by rather a loose cellular texture to the sclerotica; but on the transparent cornea adheres so firmly, that it cannot be separated by the scalpel. It differs further, where it covers the transparent cornea, in being thinner, more transparent, more polished, and less vascular.

LACRYMAL GLAND. The lacrymal gland (glandula lacrymalis) formerly called the innominata, is a conglomerate gland, of a yellowish colour, of an oval, flattened form, and about the size of a small almond. It is situated in the hollow of the orbitar process of the os frontis, at the anterior and outer part of the orbit. It is surrounded by adipose membrane, but is firmly connected to the periosteum of the orbit above. It has several extremely small *excretory ducts* which pass from the gland and terminate upon the surface of the conjunctiva, near the outer angle of the eye and edge of the upper eye-lid.

PUNCTA LACRYMALIA. At the inner angle of the eye are the *puncta lacrymalia*; two small orifices, one in the upper, the other in the under, eye-lid, at the extremity of the tarsus, marked by an eminence at that part and opposite to each other. They are very distinct in the living subject, but not so readily distinguished in the dead. The puncta are the orifices of two *canals*, which run in the direction of the edges of the eye-lids, towards the side of the nose. They are somewhat larger than the puncta. The upper passes vertically upwards for the space of a line, then turns at right angles downwards. The lower is first vertical, then nearly horizontal. They terminate together, but sometimes separately, at the upper and outer part of the lacrymal sac.

CARUNCULA LACRYMALIS. At the inner angle of the eye, between it and the globe, is situated the *caruncula lacrymalis.* It is of a conical figure, and of a red colour, from the conjunctiva being reflected over it. It consists of a cluster of small mucous glands, with minute hairs about their orifices. The *valvula semilunaris* is a doubling of the conjunctive coat, between the caruncula and ball of the eye. In quadrupeds, but still more remarkably in birds, it is of large size, called the membrana nictitans, and by means of a muscular apparatus may be drawn before the eye for its protection.

LACRYMAL SAC AND DUCTUS AD NASUM. The *lacrymal sac* is the cavity into which the tears are received; it is of a somewhat oval form, terminating above in a blind extremity: and, tapering inferiorly, is continued with the ductus ad nasum. It is situated in the lacrymal fossa, formed by the nasal process of the superior maxillary bone and the os unguis, which forms only a thin partition between it and the nose. It is immediately behind the tendon of the orbicularis muscle, above which about a fourth part is situated, and about the eighth of an inch behind the edge of the orbit. It is covered also externally by the skin, the orbicularis palpebrarum, and (towards the eye) by the caruncle and conjunctiva; it is strengthened by an aponeurosis from the tendon. The parietes are formed by a white, dense, tendinous-like membrane, and by a lining of mucous membrane continued from the pituitary membrane of the nose. At its outer and upper part is the orifice of the lacrymal ducts.

The *ductus ad nasum* is continued from the sac. It is formed by a canal in the maxillary and spongy bones, and terminates below the inferior turbinated bone. Its direction is obliquely downwards and outwards, forming a slight bend anteriorly. It is lined by mucous membrane, and its orifice has generally a fold of membrane. It is about an inch in length, and the eighth of an inch in diameter.

The parts which are next to be dissected are situated within the orbit; and it will be necessary for their examination to remove the whole of the upper part.

The orbit contains the globe of the eye, its muscles, vessels, and nerves, besides a considerable quantity of cellular membrane and adipose matter, in which these parts are imbedded.

MUSCLES. The muscles within the orbit are: one belonging to the upper eyelid, and six belonging to the globe of the eye, two of which are called the oblique, and the other four the straight, muscles of the globe.

LEVATOR PALPEBRÆ SUPERIORIS.

Origin. From the back part of the orbit near the upper margin of the foramen opticum. It passes forwards, becoming broader in its passage.

Insertion. By a broad thin tendon into nearly the whole length of the cartilage of the upper eyelid.

LEVATOR OCULI.

Origin. From the upper margin of the foramen opticum of the sphenoid bone, below the levator palpebræ superioris.

Insertion. By a broad thin tendon into the superior and fore part of the tunica sclerotica.

DEPRESSOR OCULI.

Origin. From the lower part of the foramen opticum.

Insertion. Into the tunica sclerotica, opposite the former.

ADDUCTOR OCULI.

Origin. From the inner part of the foramen opticum, between obliquus superior and depressor oculi.

Insertion. Into the inner and fore part of the sclerotic coat.

ABDUCTOR OCULI.

Origin. From the bony partition between the foramen opticum and foramen lacerum.

Insertion. Into the outer and fore part of the sclerotic coat.

OBLIQUUS SUPERIOR.

Origin. From the edge of the foramen opticum, between the levator and adductor. It runs along the pars plana of the ethmoid bone to the upper part of the orbit, where a cartilaginous trochlea is fixed to the inside of the internal angular process of the os frontis, through which its tendon passes; then runs outward and downward, inclosed in a loose membranous sheath.

Insertion. Into the tunica sclerotica, midway between the insertion of the attollens oculi and the entrance of the optic nerve.

OBLIQUUS INFERIOR.

Origin. By a narrow beginning from the outer edge of the orbitar process of the superior maxillary bone, near its juncture with the os unguis; and runs obliquely outwards.

Insertion. Into the sclerotica by a broad thin tendon between the abductor and the optic nerve.

The tendons of these muscles are seen through the tunica conjunctiva, so as to give a brilliant appearance to that which in common language, is called the white of the eye, and anatomically, in contradistinction to the transparent part, the opake cornea.

§ 2. OF THE STRUCTURE OF THE GLOBE.

The globe is nearly spherical, except where broken by the projection of the transparent cornea. Its prominence is owing to a cushion of fat, which, together with cellular membrane, fills up the orbit. It is composed of tunics and humours, together with the vessels and nerves. The tunics are commonly reckoned as three: viz. 1. *Sclerotica*, 2. *Choroides*, 3. *Retina*. But to these are sometimes added the cornea transparens and iris. The humours are also three in number: viz. 1. *Aqueous*, 2. *Crystalline*, 3. *Vitreous*.

TUNICA SCLEROTICA. Is the strongest coat of the ball of the eye. It is dense and thick, not divisible into layers, but composed of a number of fibres, interlaced together, and crossing each other in all directions. It is thickest posteriorly; strengthened anteriorly by the tendons of the muscles; and pierced by small holes for the transmission of nerves and vessels. Posteriorly, it has an opening, through which the optic nerve passes. This aperture is not in the direction of its axis, but situated towards the inner side. On the fore part it is defective, and its place is supplied by the *cornea transparens*. This occupies about the anterior fifth of the globe; projects from the surface of the sclerotic; is circular; and its circumference intimately connected, by means of an oblique edge, with the sclerotic. It is hard, dense, and transparent, but thinner than the sclerotic, and may be separated into a number of lamellæ.

TUNICA CHOROIDES. Immediately under the sclerotic is the *tunica choroides*, which begins at the entrance of the optic nerve into the eye, lines the internal surface of the sclerotica, passing between it and the retina, and terminates at the ciliary circle or ligament, to which it is firmly connected. The internal surface of the membrane is lined by a deep brown or black pigment, called the *pigmentum nigrum*, which, in the dead subject at least, penetrates the membrane, and tinges the sclerotic coat on the opposite side, but not the retina. It is in greater abundance on the anterior than on the back part, and the colour varies, somewhat according to the complexion and age of the individual. If the tunic be macerated, and the dark substance to which also its substance owes its colour removed, it becomes in a great measure transparent, and appears to be made up of vessels disposed in little bundles, connected by cellular membrane; those on the outside, disposed in whirls, are veins, called *vasa vorticosa*;

those on the inside run more parallel to each other, and are the ramifications of the *ciliary arteries.* Hence Ruysch was led to conceive, that the coat was composed of two lamellæ.

CILIARY CIRCLE OR LIGAMENT. Bounds the choroid, and gives attachment to it, anteriorly. It is seen when the sclerotic is raised from the choroid coat, at about one-twelfth of an inch behind the part, where the opake joins with the transparent cornea. It is nearly colourless; and is not of a ligamentous nature, but seems formed of a quantity of condensed cellular substance. It does not adhere firmly to the sclerotica. It likewise gives attachment to the iris.

CORPUS CILIARE AND PROCESSUS CILIARES. In order to see these, the globe should be cut through the middle of the sclerotic, and the humours removed; then, at the fore part of the choroid coat, and opposite the ciliary circle, there will be seen a black radiated ring, which is the *corpus ciliare.* The blackness is owing to the same dark substance as that of the choroid coat. This pigment is next to be washed off gently. Then behind the iris, and before the choroid, there will be observed a number of membranous folds, forming a ring, disposed like rays, narrower at the extremities, larger in the middle, and extended from the choroid to the edge of the pupil. These radiated folds begin some way on the choroid, and are covered by the pigment, which is most abundant in the interspaces. These folds are applied upon the vitreous humour and canal of Petit: and upon these, after the ciliary processes have been separated, is left the black pigment from the interspaces. These processes are continued over the edge of the lens; their internal extremities, called the *processus ciliares,* are unattached and floating in the aqueous humour of the posterior chamber.

IRIS. Is the membrane seen through the cornea, and on which the apparent colour of the eye depends. It forms a circular flattened ring. The greater circumference of which is attached to the ciliary ligament, a little behind the junction of the sclerotic coat with the transparent cornea. It forms a septum of the anterior part of the eye, dividing it into two cavities. It is perforated in the centre, forming the *pupil,* or that part through which the rays of light are transmitted to the interior of the globe. Upon its back part is a dark-coloured pigment, which, from its resemblance in colour to the grape, was anciently called the *uvea.* Its colour depends upon this pigment; for, when it is removed, the iris seems colourless. When the pigment is cleared away, the iris seems to be made up of radiated fibres; and some anatomists have described a set of circular fibres surrounding its inner edge.

Retina. Is the third membrane. The optic nerve in its continuation through the orbit, is covered by elongations of the dura and pia mater, as far as its passage through the coats of the eye. At the back part of the ball of the eye, and a little removed from the axis toward the nose, its fasciculi pass through the sclerotic, and through the choroid coat. It contracts at its passage through the sclerotic, and immediately afterwards expands and forms the retina; which extends between the choroid coat and capsule of the vitreous humour, but does not adhere to either. Arrived at the ciliary body, the retina appears to terminate; but a thin layer is continued under the ciliary processes. This may be seen by cautiously raising the choroid coat and ciliary processes in water, leaving this portion of the retina, which is very thin, upon the vitreous humour. The texture of this membrane resembles medullary substance, as far as it is tender and pulpy, and of a light grey colour; but it is semi-transparent.

Soemmering has discovered in the retina, at one-sixth of an inch outwards from the entrance of the optic nerve, directly in the axis of the eye, a central hole of a dark colour, with a yellow border, becoming paler towards the circumference. Close to it is a fold from the insertion of the optic nerve, extending about one-sixth of an inch outwards.

OF THE HUMOURS.

1. Aqueous. Is contained in the space between the cornea and crystalline lens. This space is divided into two cavities by the iris, called the *chambers*. The anterior, and by much the larger, is situated between the cornea and iris; and the posterior, between the iris and crystalline lens. The capacity of the chambers is best seen by freezing the eye. The aqueous humour is a perfectly pellucid, but slightly viscid, liquor.

2. Crystalline Lens. Is a transparent body, named from its lenticular form, with two convex surfaces, the anterior of which is less convex than the posterior; being formed of segments of spheres of unequal size. It is situated opposite to the pupil, behind the aqueous humour; and its posterior part is received into a depression on the fore part of the vitreous humour. The external part of the lens is of a soft gelatinous consistence; but it becomes denser and firmer towards the centre. The central part is composed of concentric lamellæ. This is apparent on simple inspection, but is rendered much more distinct by ma-

ceration in some astringent fluid or boiling water. The lamellæ have numerous striæ on their surfaces, which pass like radii from the centre to the circumference: they seem, therefore, to be of a fibrous structure.

The lens is surrounded by a *proper membrane,* which completely envelopes it. It is quite pellucid, is thicker than the tunica vitrea, and has been compared in structure to the cornea. It is situated between two layers of the tunic of the vitreous humour. Between the lens and its capsule is a small quantity of *aqueous fluid* (liquor Morgagni), which flows out as soon as the capsule is opened.

3. VITREOUS HUMOUR. Is the largest in quantity of the humours, filling the posterior part of the globe, and occupying more than three-fourths of the eye. It is convex on all sides, except anteriorly, where it lodges the crystalline lens. It is pellucid, and thicker than the aqueous, being viscid or gelatinous in consistence. It is inclosed within a very delicate membrane, called *tunica vitrea, (aranea, hyaloidea);* which, like the humour, is quite transparent. This tunic sends processes within, forming cells, in which the humour is contained; as may be seen after boiling, or congelation, or by the action of acids. These cells communicate: so that, if a puncture be made, the humour oozes out through it.

At the edge of the crystalline, the tunica vitrea divides into two laminæ; the one of which gives an anterior covering to the lens, and the other passes behind it. By their separation a canal is formed, which passes around the crystalline lens, and is called the *canal of Petit.* It contains no fluid; and its two laminæ, which are closely applied to each other, may be rendered distinct by inflation. The anterior lamina is sometimes called *membranula coronæ ciliaris,* or *zonula ciliaris,* and has a striated appearance.

CHAPTER III.

Of the Mouth, and Parts connected with it.

The mouth is formed, anteriorly, by the lips; behind, by the velum palati and the opening to the pharynx; above, by the palatine vault; below, by the tongue and membrane of the mouth; on the sides, by the cheeks.

The bony parts are the ossa maxillaria superiora, the ossa palati, the maxilla inferior, and the teeth. The soft parts are: the lips, cheeks, gums, palate, tongue, membrane lining the mouth, and salivary glands.

Lips and Cheeks. The *lips* are distinguished by the name of *superior* and *inferior*. They terminate by an edge, more or less thick, which is remarkable for its red colour, when compared with the neighbouring skin. They are united at the outer angles, by the *commissures*. Externally, the superior has a longitudinal depression from the septum of the nose, called the *filtrum*. Internally, they are covered by the membrane of the mouth, which about the middle forms a fold, named the *frænum*, connecting each lip to the corresponding maxillary bone. Upon the edges of the lips, which are covered by a continuation of the membrane of the mouth, are numerous fine villi, which may be distinguished after a fine injection, and the removal of the cuticle by maceration. The lips and cheeks are formed of muscles, common integuments, membranes, glands, and their vessels and nerves. Between the masseter and buccinator, the space is occupied by a large quantity of fat. The *glands* of the lips and cheeks are small rounded bodies, situated beneath the internal membrane in considerable number. They have each an *excretory duct*, by means of which they pour out a viscid fluid to lubricate the adjacent parts. Those on the lips are named the *labial glands*—those on the cheek, the *buccal*.

Tongue. Occupies the space of the arch of the inferior maxilla between the teeth. It is divided into its *body*, *base*, and *apex*. On the body are distinguished an upper and an under surface, and two sides or edges. The *upper surface*, or *dorsum*, is divided into two equal halves, by a linea mediana, or middle groove, called sometimes the *raphe*, running longitudinally. The *inferior surface* is, anteriorly, smooth from its covering, which is a continuation from the membrane of the mouth. It is divided by a longitudinal depression, which separates the projection of the muscles; its posterior half is connected to the parts below, by the sublingual ligament, or *frænum linguæ*, which is a triangular fold of the lining membrane. The *sides* of the tongue are thicker posteriorly than anteriorly; they are round and smooth; and are fixed to the lower jaw, the styloid processes, and the parts adjacent, by membranous ligaments. The *apex*, or tip, is moveable, and more or less rounded. The *base* or posterior part of the tongue, is connected to the os hyoides, and by the medium of this to the adjacent bones and muscles, as also to the epiglottis and the anterior pillars of the fauces.

The tongue is chiefly composed of *muscular fibres*, which are in part derived from the muscles which serve for its motions. These are the linguales, stylo-glossi, genio-glossi, and hyo-glossi. The muscular fibres of the substance of the tongue form by their interlacement a network so intricate as to preclude the possibility of unravelling its fibres. These fibres are united by a very fine and close cellular texture, in which some fat is found.

The tongue is covered by a *membrane*, which is continuous with that of the mouth, and is similar to the common integuments. The cutis vera is plentifully supplied with nerves, and covered with small projecting bodies, called the *papillæ*, dispersed over the upper surface of the tongue. They are divided into three kinds:—the capitatæ, lenticulares, and conicæ. The *capitatæ* (maximæ, lenticulares, vallatæ) are the largest; and, as their name implies, have a rounded head, with a short stem. They are placed at the base of the tongue, in superficial fossulæ, and the whole are arranged in such a way as to form an angle, with its point backwards. Their number and size vary. Their head has a cup-shaped depression. They are of a firm consistence, and seem formed of the ramifications of blood-vessels and nerves, united by cellular texture.

The *lenticulares* (semi-lenticulares, mediæ, fungiformes) are smaller than the former, and are scattered over the whole surface of the tongue, at some distance from each other.

The *conicæ* (minimæ, villosæ) are the smallest and most numerous. They occupy almost the whole upper surface of the tongue, but are most abundant towards the apex; are connected by their bases to the tongue; but having the apices free. The posterior are the larger, and their direction perpendicular; the anterior and smaller, are somewhat inclined and more moveable.

The papillæ are formed principally by the nervous filaments of the lingual branch of the fifth pair, which terminate by minute points, surrounded by a network of vessels.

At the root of the tongue, besides the papillæ, are numerous *mucous follicles.* Behind the angle formed by the papillæ maximæ, is an orifice, likewise of a mucous follicle, called from its first describer, the *foramen cæcum of Morgagni.*

The SALIVARY GLANDS have already been described. The *parotid gland,* p. 98: the *submaxillary gland,* p. 105: and the *sublingual gland,* p. 107.

CHAPTER IV.

Of the Nose, and Parts connected with it.

§ 1. OF THE NOSE.

The nose is divided into an *external* prominent part, and an *internal* formed of two cavities.

External Part. Is of a pyramidal figure.—On its outside we distinguish:—the *radix*, or upper part; the *dorsum*, or middle prominence; the *apex*, or point; the *alæ*, or lateral moveable parts; the *columna*, or under part of the partition next the upper lip, which separates two openings, called the *nostrils*, leading to the internal cavities, about which are some small hairs, called *vibrissæ*. It is composed superiorly of bone, and inferiorly of cartilage. It has a partial covering of muscle, and a general one from the common integuments. It is lined by a mucous membrane.

Cartilages. Are one large single one which assists in forming the septum of the nose, and four smaller ones situated at its sides.

Cartilage of the Septum. Is the middle and most considerable cartilage; of a somewhat triangular figure. Its base or superior edge is joined to the anterior edge of the nasal lamella of the ethmoid bone. The inferior edge is received within the two edges of the vomer. The anterior edge forms the dorsum of the nose, and is united with the lateral cartilages. It is very thick above, but becomes gradually thinner as it descends, and terminates by a short rounded edge, which projects between the cartilages of the alæ.

Lateral Cartilages. Are two in number, extending from the middle cartilage. They are placed somewhat obliquely at the side of the nose, and are connected by short ligamentous fibres to the edge of the nasal bones and nasal process of the superior maxillary bones, and to the cartilages of the alæ by a ligamentous substance. They are of a triangular figure, and externally more or less convex.

CARTILAGES OF THE ALÆ. Are two in number. Their shape is irregular, but so as to form the greater part of an oval, being composed of two branches united in front. Between the lateral and the alar cartilages are small cartilaginous bodies, of which the number, size, and figure vary.

Having attended to these points, it will be proper to make a section of the head in order to display the internal parts of the nose, together with the cavities and openings connected with them. For this purpose the one half of the lower jaw should be removed, and in so doing it should be carefully detached from the parts connected with it. The next object will be to cut out a suitable portion of the bones of the head and face: it may be done (after having removed the brain) by applying the saw to one side of the crista galli, on a line drawn from the os frontis to the sella turcica, then sawing perpendicularly through the frontal, sphenoid and ethmoid bones into the cavity of the nose, on the same side: the bony palate and palatine bone are then to be sawed through from below in the same direction. The saw is next to be applied at a point on the parietes of the cranium, corresponding to the anterior edge of the glenoid cavity, and a cut is to be made which shall meet the first at the sella turcica, and is then to be carried perpendicularly through the basis of the cranium. These cuts will insulate a triangular portion of the bones of the head and face. Their removal will give an opportunity of examining several parts requiring notice, viz.—The extent and form of the cavities of the nose.—The openings into each from the lacrymal sac, the antrum maxillare, the frontal, ethmoidal and sphenoidal sinuses.—The passage of the fauces with its pillars, the uvula, the situation of the tonsils, and the mechanism of the velum pendulum palati.—The extent and form of the pharynx, with the situation and relation of the openings into it from the nose, mouth, ears [Eustachian tube], larynx, and œsophagus.—The form of the posterior part of the tongue.—The mechanism and situation of the epiglottis.

INTERNAL PART OF THE NOSE. Comprehends the internal nares or cavities of the nose. These cavities have an irregular form, and are divided by the septum. Their greatest extent is from behind to before; and their breadth is the least considerable dimension. Their direction is a little oblique from before hindwards. They are formed; above, by the cribriform plate of the ethmoid bone in the middle, by the bones of the nose anteriorly, by the sphenoid bone behind; and below, by the horizontal portions of the maxillary and palatine bones. To the outer side they present an irregular surface, formed by the ethmoid and inferior turbinated bones, which make two projections, and divide the external part into three meatus, or passages:—1. *Meatus narium superior,* which is the smallest, is placed at the upper, inner, and back part of the superior turbinated bone:—2. *Medius,* between the superior and inferior turbinated bone:—3. *Inferior,* between the inferior turbinated bone and bottom of the nose.

Mucous Membrane of the Nose. The inside of the nose is lined with a thick, soft, and spongy membrane, the *membrana mucosa, (pituitaria, Schneideriana).* This not only covers the internal parietes of the nose, but is continued into the different cavities connected with the nose. It is redder than the other mucous membranes. It is thin where lining the external nose, it is thicker in the nasal cavities, and diminishes again in the sinuses. The spongy texture is most remarkable on the turbinated bones. On its surface are observed numerous minute orifices, as if from the prick of a pin, and are the openings of the *mucous follicles.* No glands can be observed in the membrane, nor distinct villi.

§ 2. OF THE CAVITIES CONNECTED WITH THE NOSE.

There are several cavities or sinuses situated in the bones connected with the nose, and opening into the cavity of the nose. The ethmoid bone, it will be recollected, is formed in a great measure of thin plates of bone, so disposed as to form small canals or cells, called the *ethmoidal cells* or *sinuses.* There are two sets of these distinct from each other. The posterior, opening into the nose above the superior turbinated bone; the anterior, having a common canal of communication with the frontal sinuses, terminate in the anterior part of the nose in the middle meatus. The *frontal sinuses* are cavities in the frontal bone, in its thickest part; they are large below, but become smaller as they ascend; but vary in size, not seldom reaching to the orbitar process, and are separated by a middle partition, which is sometimes perforated. The *sphenoidal* *sinuses* are cavities, found within the body of the sphenoid bone. Sometimes there is one only. They open behind the posterior ethmoidal cells, into the upper and back part of the nose. The *maxillary sinus* (antrum Highmorianum), is situated in the superior maxillary bone. It is of a conical form; having its base inwards, its apex outwards. It is separated from the orbit; above, by a thin plate, in which is the suborbitary canal; below, by a thin partition from the alveoli of the molar and bicuspides teeth, so that sometimes the roots of these teeth are found to perforate the septum. It is strengthened on the outer side by the malar projection. When this is raised, the thin layer of bone covering the sinuses, is often broken. Behind, it has the tuberosity of the superior maxilla. Its base corresponds to the nasal cavities, with which it communicates by an opening between the turbinated bones; this appears larger than it is found to be, when the bones are separated. At the upper part of this sinus, *appendices* are sometimes found, which communicate with the ethmoid cells. Besides these the *ductus ad nasum* terminates below the inferior turbinated bone near its middle, about half an inch behind the nasal process of the superior maxillary bone; its orifice has often a loose membranous fold.

These cavities are all lined by a continuation of the pituitary membrane; but in them it is thinner and less vascular than that which lines the cavity of the nose.

§ 3. OF THE PARTS AT THE PASSAGE OF THE FAUCES.

The mouth is bounded posteriorly by the *velum pendulum palati*, or *palatum molle*, a kind of curtain which depends from the edge of the ossa palati, and from the pterygoid processes of the sphenoid bone, and forms a partition between the mouth and pharynx. Above, where it is fixed to the bones, it is of considerable thickness. Its inferior part forms an unattached edge; in the middle of which the *uvula* (or pap of the throat) takes its origin, and hangs over the root of the tongue. This is of a conical shape, and varies in length. The edges of the velum are continued to the tongue and pharynx, by two membranous and muscular folds on each side, which singly are called the *pillars*, and each pair the *arches of the fauces*. At the side of the uvula these are close together, but as they descend they separate; so that the anterior pass obliquely, and terminate at the base of the tongue; while the posterior pass nearly perpendicularly and are lost on the sides of the pharynx. A kind of triangular space is left by their separation, which lodges on each side the *tonsil gland.*

These parts are formed by:—a doubling of the mucous membrane, being a continuation anteriorly of the membrane lining the palate; and posteriorly, of the pituitary membrane. The first is the paler, the latter having a considerable degree of redness. Beneath the first are a number of small glands of a yellowish colour, the excretories of which are not distinct. The uvula is also surrounded by these glandular bodies. Beneath the mucous membrane are found muscles; in the middle the azygos uvulæ; in the velum, the expansions of the circumflexus and levator palati; in the anterior pillar the constrictor isthmi faucium; in the posterior the palato-pharyngeus. The parts are strengthened by their tendinous expansions. The opening to the pharynx is nearly quadrilateral, bounded above by the arch of the palate, or by the velum, when it is let down; at the sides by the pillars and tonsils; and at the bottom by the base of the tongue. The size of the passage cannot be much enlarged; for when the velum is elevated, the tongue is pressed backward.

TONSILS. Are glandular bodies of a reddish colour, situated in the space between the pillars of the fauces, by the sides of the base of the tongue. They are longest in their vertical diameter, and hence they have been called the *amygdalæ*, or *almonds;* but they vary in their figure. They are made up of several lobes which are more or less connected with each other: and are of a soft and pulpy texture. In regarding them from the mouth their surface seems studded with openings of some size, which lead into small cavities, disposed like cells, occupying the interior of the gland. These are more distinct at the upper part, but vary in form and disposition. They generally communicate with each other, so as to give to the gland at that part the appearance of network. They are lined as well as their orifices with the membrane of the mouth, and upon their surface there open out excretory ducts.

§ 4. OF THE PHARYNX.

Is a large muscular bag in the form of an irregular funnel, with the œsophagus descending from it, and forming its under end. It is bounded above by the cuneiform process of the os occipitis, anteriorly by the pterygoid processes and jaws, and the larynx, with all of which it is connected. Posteriorly it lies upon the cervical vertebræ, and upon the muscles which cover them, with which it is connected by loose cellular membrane: from the cranium to below the opening into the larynx the two sides are separated; but lower down they are applied to each other except during deglutition. It corresponds laterally to the internal carotid arteries, and the internal jugular veins.

There are seven openings in it, by which it communicates with the neighbouring cavities. At its upper part the *posterior openings of the nares* vertically oblong, separated by the posterior edge of the septum. Below these is the velum palati, and below it the *isthmus of the fauces,* the opening of communication between the mouth and pharynx. Lower down the base of the tongue, and then the epiglottis, a moveable cartilage belonging to the larynx: this covers the *opening into the larynx.* At the upper and anterior part of the lateral parietes are the openings of the *Eustachian tubes* projecting from the sides, turned forwards and inwards, and seeming rather to open into the nares. The superior extremity of the pharynx forms a blind extremity, and occupies the space between the openings of the nares and the condyles of the os occipitis. The inferior extremity opens into the upper extremity of the *œsophagus* with which it is continuous.

The pharynx is surrounded by a loose cellular membrane which unites it to the surrounding parts. Its *muscular part* is formed of four muscles on each side, described in the myology; pharyngeus superior, medius and inferior, and the stylo-pharyngeus. It is lined by a *membrane* which is continuous with that of the nose, of the mouth, larynx, and œsophagus. It is thickest at the upper part; is very thin on the posterior surface of the larynx, and has a plicated appearance. It is covered by a very thin epidermis, and perforated by the *ducts of numerous glands,* situated on its external surface; and which are most abundant at the upper part.

§ 5. OF THE THYROID GLAND.

The thyroid gland is situated at the lower and lateral parts of the larynx and upper and anterior part of the trachea. It is large in the fœtus, but afterward decreases in size. It is formed of two lobes joined by a narrow slip, sometimes wanting, which crosses the trachea a few lines below the cricoid cartilage. Sometimes a process from the middle portion, which may be mistaken for a muscle, ascends between the sterno-hyoidei, and is fixed to the base of the os hyoides. The lobes begin at the sides of the cricoid cartilage, and descend a certain way upon the trachea and œsophagus. They are covered anteriorly by the sterno-hyoidei, the sterno-thyroidei and the omo-hyoidei. The gland is of a reddish brown colour, resembling in appearance the lymphatic glands. It is of a firm consistence. Internally it presents a granulous and often cellular appearance.

(Practical Points.)—Situation, growth, and removal of Polypi from the nose.—Diseases of the antrum maxillare.—Passing a probe into Eustachian tube.—Extraneous bodies lodged about glottis. Introduction of a pipe (as in suspended respiration) into the œsophagus or opening into the larynx.—Passing bougies into the œsophagus.—Extirpation of tonsils.

CHAPTER V.

Of the Larynx and its Appendages.

THE larynx consists of several moveable cartilages connected by ligaments, together with muscles and membranes, forming a cavity of an irregular figure. It is situated superficially at the upper part of the trachea, and below the os hyoides, with both which it is connected. Behind it rests on the bodies of the vertebræ and pharynx.

The CARTILAGES are five in number, viz. the thyroid, cricoid, the two arytenoid, and the epiglottis.

THYROID CARTILAGE. The thyroid, or *shield-like* cartilage, which is the largest of the five, is placed at the upper and fore part of the larynx. It is larger above than below, and its breadth exceeds its length. It consists of two lateral quadrangular portions united in the middle at an angle more or less acute, which may be felt beneath the integuments. This is more prominent in men than in women, and is called the *pomum Adami*. The upper part of this angle is formed into a *notch*. The lateral portions or *alæ* have a plane, or but slightly concave, surface, covered principally by the thyreo-hyoidei. An oblique and projecting line extends upon this surface, and gives attachment to the sterno-thyroideus and the inferior constrictor of the pharynx.

These surfaces are terminated by four *edges;* the superior and more considerable of which, conjointly with the notch, gives attachment to a *broad ligament*, by which it is fixed to the under part of the os hyoides. The inferior edge is shorter, and concave in the middle; while the posterior edges have an oblique direction, and are concave above and convex below; and are terminated at the corners by processes called *cornua*. The two *superior* are more or less lengthened, and have an oblique direction backwards. They are connected by round ligaments to the extremities of the cornua of the os hyoides. In the middle of these ligaments one or two small cartilaginous or osseous bodies are frequently found. The other two cornua, called *inferior*, are shorter, curved forwards, and fixed by smooth articulating surfaces to the sides of the cricoid cartilage.

CRICOID CARTILAGE. The cricoid, or *annular* cartilage, forms the inferior and posterior part of the larynx, and may be readily felt in the fore part of the throat. It is narrow before where it lies under the thyroid, and thick and broad posteriorly. Its external surface has, anteriorly, a convexity which is subcutaneous. Behind, where it is largest, it presents nearly a quadrilateral surface, upon the middle of which is a perpendicular ridge dividing it into two lateral cavities for the reception of the crico-arytenoidei-postici muscles. The superior circumference is anteriorly hollowed out, to which part is attached the membranous ligament connecting it with the thyroid cartilage. The inferior circumference is nearly horizontal. It is connected to the first ring of the trachea by a membranous ligament like that which connects the other rings. It has four small articular surfaces, two of which are situated above and behind for the articulation of the arytenoid cartilages, and the two others at the under and lateral parts for the connexion of the inferior cornua of the thyroid cartilage. They are provided with capsular ligaments.

ARYTENOID CARTILAGES. These are two in number. Are much smaller than the other cartilages, and are placed upon the upper, posterior, and lateral parts of the cricoid cartilage at a small distance from each other. Their form is pyramidal. They have each a concavity on the posterior surface for the arytenoidei muscles. Their *base* has an oval concave articular surface, covered by synovial membrane, which corresponds to an analogous surface on the cricoid cartilages, and posteriorly forms a triangular projection, which gives attachment to the ligament connecting it with the thyroid cartilage.

On the anterior surface of the arytenoid cartilages, is a glandular body (*arytenoid gland*) seemingly composed of an aggregation of mucous glands.

EPIGLOTTIS. Is situated at the upper part of the larynx, between it and the tongue, and covers the opening of the larynx. It appears oval, but when divested of its membrane, its form is that of a purslain leaf; it is broad above close to the tongue and rounder, but narrows below, and terminates in a point. The upper surface next the tongue is convex, with its point reflected forwards, and it is covered by the mucous membrane of the mouth, the membranes forming two loose folds at the sides, and a fold in the middle, called the *frænum epiglottidis.* The surface towards the glottis is concave and covered by the laryngeal membrane, fixed to the notch of the thyroid cartilage by a broad short ligament, and by two lateral ligaments, and by the membrane to the whole length of the arytenoid cartilages. It is of a ligamento-cartilaginous nature, and much more pliable than the other cartilages. It has numerous perforations like the pricks of a pin which lodge a number of *mucous glands* covered by the membrane.

LIGAMENTS OF THE GLOTTIS. Besides those which have been mentioned, there passes from the projection of the base of each arytenoid cartilage a *ligamentous cord* (lig. thyreo-arytenoideum) horizontally forwards, to be fixed by its other extremity to the inside of the anterior angle of the thyroid cartilage, The opening formed between these ligaments is called the *glottis, mouth of the larynx,* and *rima glottidis;* it is of a triangular figure, the ligaments being in contact before but at a distance from each other at their posterior extremities. Under these two ligaments there are two others, larger and more distinct than the former, and considered as the *proper ligaments of the glottis.* These arise from the base of the arytenoid cartilages, run in the same direction as the former, and like the former are fixed to the thyroid cartilage. In the interstice of the superior and inferior ligament on each side, there is a fissure which leads to a small membranous cavity with its bottom turned out. These cavities are the *sacculi laryngis* or *ventricles* of the larynx of Galen.

The cavity of the larynx is lined by a MEMBRANE of a mucous nature continued from the mouth and pharynx, but less red. It is perforated by the mouths of small mucous glands.

MUSCLES OF THE LARYNX. The larynx has a number of muscles for its different motions. These are of two kinds—the one common to it and other parts. They are: the sterno-thyroidei, thyreo-hyoidei, and pharyngeus inferior; together with those attached to the os hyoides, the movements of which are communicated to the larynx especially. The others proper to it are situated in what may be called the—

LARYNGEAL REGION. They are:—

1. CRICO-ARYTENOIDEUS.

Origin. Fleshy from the posterior broad portion of the cricoid cartilage.

Insertion. Into the back part of the base of the arytenoid cartilage.

2. CRICO-ARYTENOIDEUS LATERALIS.

Origin. Fleshy from the side of the cricoid cartilage, concealed in a great measure by the thyroid cartilage.

Insertion. Into the side of the base of the arytenoid cartilage.

3. THYREO-ARYTENOIDEUS.

Origin. From the middle of the internal surface of the thyroid cartilage.

Insertion. Into the arytenoid cartilage above the former muscle.

4. ARYTENOIDEUS OBLIQUUS.

Origin. From the base of one arytenoid cartilage, and crosses its fellow.

Insertion. Into the tip of the other arytenoid cartilage.

One or the other of these is frequently found wanting.

5. ARYTENOIDEUS TRANSVERSUS.

A single muscle.

Origin. From nearly the whole length of the side of one arytenoid cartilage. Its fibres pass transversely.

Insertion. In the same manner into the side of the other arytenoid cartilage.

Besides these muscles there are some pale fibres which have been considered by some anatomists as distinct muscles, and are named :—

1. THYREO-EPIGLOTTIDUS.

Origin. From the thyroid cartilage.

Insertion. Into the epiglottis laterally.

2. ARYTENO-EPIGLOTTIDEUS.

Origin. From the side and upper part of the arytenoid cartilage. It passes by the side of the opening of the larynx.

Insertion. Into the epiglottis.

CHAPTER VI.

Of the Ear.

THE organ of hearing is divided into the external and internal ear.

§ 1. OF THE EXTERNAL EAR.

The EXTERNAL EAR comprehends the ear so called, that is, the external appendage or auricle, and the meatus auditorius externus.

AURICLE. It has an irregular figure, and is distinguished into the pinna and lobus.

The *pinna* is the larger and whole superior part; and its *external surface* is divided into different depressions and eminences, which have received particular names. *Eminences:*—1. *Helix,* a nearly semi-circular eminence, which forms a rounded margin beginning at the lobe and terminating nearly opposite to its origin within the concha, which it divides. The portion extending across the concha is sometimes called *septum conchæ.* 2. *Anti-helix,* surrounds the concha, and is situated within the former, beginning by two eminences which coalesce. 3. *Tragus,* a small eminence lying over the meatus and connected to the under and fore part of the helix. It is covered by small hairs. 4. *Anti-tragus.* Opposite the former, less considerable below the inferior extremity of the anti-helix. *Cavities:* 1. *Fossa innominata,* situated between the helix and anti-helix. 2. *Scapha,* or fossa navicularis, situated between the two divergent extremities of the anti-helix. 3. *Concha.* Is a larger cavity bounded by the helix, tragus, anti-helix, and anti-tragus: divided into two parts by the termination of the helix, or septum conchæ. The upper and smaller is continued behind the helix with the fossa innominata, the lower and larger leads to the meatus externus.

The back part or inner surface of the pinna is irregularly convex. The *lobus* is the inferior soft and pendent part of the ear; it is composed of cellular substance with a small quantity of fat.

The *auricle* is covered by a continuation of the common integuments, which are thinner here than in most other parts of the body, and are perforated by the mouths of sebaceous follicles. A *cartilaginous* structure gives form to the pinna of the external ear, and sends an elongation to assist in forming the meatus. It is connected to the temporal bone by the common integuments, and by itsmuscles, and is furnished with ligamentous expansions which connect it to the zygoma, mastoid process, and lateral parts of the head. Some small and generally indistinct muscles are situated on the cartilage. They are:—1. *Helicis major*. Above the tragus, covering the beginning of the helix.—2. *Helicis minor*. On the transverse eminence which divides the concha.—3. *Tragicus*. On the tragus, beginning at the base of the tragus externally, and terminating at its apex. 4. *Anti-tragicus*. Occupies the space between the anti-tragus and anti-helix, beginning on the former and terminating on the latter by oblique fibres.—5. *Transversus auris*. Situated on the back part. It begins on the prominent part of the concha, and terminates on the outside of the anti-helix.

MEATUS EXTERNUS. In order to examine the course of the meatus, its anterior wall must be cut away as far as that portion which sustains the membrana tympani. It is situated between the mastoid process and glenoid cavity, and extends from the convexity of the concha to the membrana tympani. Its perpendicular section presents an oval figure. Its length somewhat varies, being in the fœtus only a bony ring, which in the adult becomes a tube of about an inch in length. Its course is slightly tortuous; it is first directed upwards and forwards, and then turns a little downwards and backwards, so that on the whole it is convex above and concave below. The turns, however, are so inconsiderable, that the bottom of the passage may be seen in a clear light by pulling the ear backwards.

The meatus externus is partly bony and partly cartilaginous. The cartilaginous part is continued from the concha, and is of an irregular figure. It has two or three fissures commonly, and at the upper and back part it is defective. At the fissures, and at the part where it is defective, its place is supplied by ligament, which serves to fix it to the bone. The osseous part is continued from the cartilaginous; and is the longer of the two. The canal is lined by a continuation of the common integuments, covered by a soft down and frequently by hairs of some length, more particularly at the entrance of the meatus; and upon it we may observe the mouths of sebaceous ducts and small pores belonging to the glandulæ ceruminosæ. The skin adheres but slightly to the cartilage, but is firmly united to the osseous part, upon which it becomes so thin as scarcely to be distinguished from the periosteum. It passes upon the membrana tympani, and covers its outer surface, so as to terminate in a complete cul de sac.—During putrefaction it may be drawn out entire.

At the upper and back part where the cartilage is defective, and under the skin, are lodged the *ceruminous glands* (glandulæ ceruminosæ). These are small oval bodies, of a yellowish red colour. They each open by a small *excretory duct* into the meatus.

§ 2. OF THE INTERNAL EAR.

The internal ear comprehends the tympanum, the labyrinth, and certain passages connected with these.

MEMBRANA TYMPANI. The tympanum is separated from the meatus by the *membrana tympani;* which is a firm transparent membrane of an oval form, having its circumference fixed in a groove of the bone, and its direction oblique, so that it faces forward and downward, rendering the meatus longer below than above. The membrana tympani is tense; but its middle presents a concavity towards the meatus, and a convexity towards the tympanum, to which the extremity of the malleus is attached. It is formed of three layers: an outer one, before described, of common integuments; an internal one, which is a continuation of the membrane lining the tympanum, and which it is difficult to separate: and of a third, which is the proper membrane.

In order to examine the tympanum it is necessary to cut away its upper part.

OF THE TYMPANUM.

The *tympanum* is a cavity of an irregular figure, situated within the petrous portion of the temporal bone, at the extremity of the meatus, and above the glenoid cavity.

To its inner side is placed the labyrinth from which it is separated by an osseous septum, in which there are several eminences, and two remarkable openings, called the fenestra ovalis and fenestra rotunda. The *fenestra ovalis* is situated at the upper and inner part of tympanum; its greatest diameter is horizontal. The upper and under edges are convex upwards. It communicates with the vestibule; but is filled by the base of the stapes, connected at its edge by a very delicate *membrane.* Superiorly, the fenestra ovalis is bounded by a *rounded eminence,* formed by the aqueductus Fallopii. Below, it is bounded by another and more considerable eminence, called the *promontory.* It is formed by the outer side of the vestibule and the beginning of the scala tympani. Above and before the promontory is the extremity of the *thin bony plate,* over which the tensor tympani runs. Below the fenestra ovalis, at the under and back part of the promontory, is a smaller opening, which, though called the *fenestra rotunda,* is rather triangular than round. It is shut up by a membrane which prevents any communication between the tympanum and the cochlea.

Below, and a little anteriorly, is the *glenoid fissure,* through which pass the chorda tympani, and the laxator tympani muscle.

MASTOID CELLS. *Posteriorly,* at the upper part of the tympanum is an open short canal, directed obliquely downwards and backwards, which leads to a number of cells occupying the mastoid process, called the *mastoid cells.* These vary considerably in disposition, number, and size; but all communicate with one another. Near to and above the canal is a bony eminence, called *eminentia pyramidalis;* which is hollowed for the reception of a small muscle, the stapedius.

EUSTACHIAN TUBE. *Anteriorly,* the tympanum communicates with the *Eustachian tube,* or iter a palato ad aurem. This is directed obliquely inwards and forwards from the upper and fore part of the tympanum to the superior and posterior part of the opening of the nares, and terminates at its outer edge, above the palate. It is about an inch and a half in length. It is narrow and rounded at its origin within the tympanum, but becomes larger, and terminates in a projecting, wide extremity, with prominent sides. It is composed of a bony posterior part, and a cartilaginous and membranous anterior part. The bony part forms the posterior third of the canal. The other two thirds are formed by cartilage and membrane; of these the whole of the posterior, and a part of the anterior wall is formed by cartilage; but the fore part towards the extremity is composed of a dense membranous substance. It is lined by a continuation of the membrane of the pharynx and tympanum.

OSSICULA AUDITUS. The tympanum contains four small bones called *ossicula auditus,* which extend across from the membrana tympani to the labyrinth. The bones are:—the malleus, incus, stapes, orbiculare: the three former named from their supposed resemblance to a hammer, an anvil, and a stirrup.

The MALLEUS consists of a round *head*, a small *neck*, a *manubrium* or handle, and two small processes, one in the neck which is long and very slender, called *processus gracilis;* the other in the upper end of the handle called *processus brevis.* The handle forms an angle with the neck, becoming gradually smaller and incurvated towards the extremity, which is connected with the membrana tympani.

The INCUS resembles a molar tooth with its roots widely separated; it is placed behind the malleus, towards the mastoid cells. It is divided into a body and two crura. The *body* consists of an articular surface which forms a cavity with two eminences for receiving the malleus. The *crura* are of unequal length. The shorter and superior is placed nearly horizontally, and is articulated in a little depression near the aperture of the mastoid cells. The ligaments which retain it allow a considerable degree of motion. The longer and inferior is more slender; its direction is nearly perpendicularly downwards, and parallel with the manubrium of the malleus. It is articulated with the os orbiculare, which is received into a slight cavity.

The OS ORBICULARE is hardly as big as a millet-seed; it is rather of an oval figure. It connects the incus and stapes, but is more firmly attached to the former, of which it has sometimes been considered a process.

The STAPES has a strong resemblance to a stirrup. It is divided into a head, crura, and base. The *head* is placed upon a short *neck*, and slightly excavated to receive the os orbiculare. The *crura* are bent; that which is nearest the mastoid cells is, however, most incurvated and longer. They are grooved on the inside, and a membrane occupying the area of the stapes is fixed in the groove. The *base*, situated a little higher on the head, is of an oval figure, and is adapted to the fenestra ovalis, with which it is connected by a delicate membrane.

These bones are articulated with each other by means of *capsular ligaments* proportioned to their size, and are covered by a delicate *periosteum.*

MUSCLES. The bones have small *muscles* fixed to them; two belonging to the malleus, and one to the stapes: viz.—

TENSOR MEMBRANÆ TYMPANI. Is contained in a small bony canal, parallel with the Eustachian tube.

Origin. From the cartilaginous portion of the Eustachian tube. The fibres are collected into a long round muscle, that passes through the canal above mentioned, and enters the tympanum, by a slender round tendon. The tendon issuing through a small aperture, at an obtuse angle to the line of the muscle, makes a turn towards the manubrium of the malleus.

Insertion. Into the manubrium of the malleus, a little below the long process.

LAXATOR MEMBRANÆ TYMPANI.

Origin. From the extremity of the spinous process of the sphenoid bone, and from the Eustachian tube. Takes its course backwards and outwards toward the glenoid fissure.

Insertion. By a short tendon into the long process of the malleus.

STAPEDIUS.

Origin. From the cavity of the eminentia pyramidalis, in which it is contained. It has a very short tendon, which passes through an opening in it.

Insertion. Into the posterior part of the neck of the stapes.

OF THE LABYRINTH.

The labyrinth consists of the vestibule, the cochlea, and the three semi-circular canals.

VESTIBULE. The vestibule has, to the outer side, the tympanum; to the inner, the meatus auditorius internus; anteriorly, the cochlea; behind, the semi-circular canals. The shape of the vestibule is irregularly spherical; it is about the size of a grain of barley. In it there are several *openings*, which communicate with the neighbouring parts; viz.—1. To the outer side, the fenestra ovalis; but which is closed, as has been before described.—2. Above, there are two *openings* which communicate respectively with the vertical and horizontal semi-circular canal.—3. Behind, there are three; one communicating with the posterior, a second with the horizontal, and a third the common orifice of the vertical and oblique semi-circular canals.—4. At the fore and under part, a round hole, which communicates with one of the canals of the cochlea. At each opening is commonly a slight excavation.

Besides these, near to the common orifice of the vertical and the oblique semi-circular canals, there is a small opening, more or less distinct, which is the beginning of a canal, called the AQUÆDUCTUS VESTIBULI, which takes its course upwards, then backwards and downwards, and terminates on the posterior surface of the petrous portion of the temporal bone, behind the meatus, and half way between its upper edge and the diverticulum of the internal jugular vein.

SEMI-CIRCULAR CANALS. Three in number.—They correspond below and behind to the mastoid cells, forming about three-fourths of a circle. They are named from their position or direction: viz.—1. *Vertical* or *superior*.—2. *Oblique* or *posterior*.—3. *Horizontal* or *exterior*. The VERTICAL forms its curve at the summit of the petrous portion, which it crosses (transversely) with its convex side above. The OBLIQUE, inferior to the last, describes its curve on the occipital side of the petrous portion; its convexity placed below and outwards. The HORIZONTAL is the smallest; it has its convexity towards the mastoid process, and is directly above a portion of the stylo-mastoid canal. The canals have a calibre about the size of a common pin, and are of an elliptical figure. They each enlarge as they enter the vestibule, and have an *ampulla*, or *cavitas elliptica*. The orifices are only five in number, as has been described; the smaller extremity of the vertical joining with the small extremity of the oblique, and forming a common orifice. These are not closed by any membrane.

COCHLEA. Is so named from its resemblance to the shell of a snail. It is conical; but lies more inwards than the vestibule, and before the meatus internus; and has its direction obliquely downwards and outwards, so that its base is towards the meatus internus, while its apex faces outwards. The cochlea is constructed with a modiolus or central pillar, around which are wound a spiral tube, and a spiral lamina lying within the spiral tube, and dividing it into two canals.

The MODIOLUS commences from the bottom of the meatus internus, by a concave plate, which is full of small holes (cribriform). They are the extremities of small bony tubes, which run from the base toward the apex, and communicate with each other. These being blended into a mass of a conical figure, form the modiolus, and terminate on its sides. As they terminate, the modiolus diminishes, and at its apex becomes exceedingly slender. The *infundibulum* is an imperfect funnel, the apex of which meets that of the modiolus; its base is covered by the apex of the cochlea, which is called the *cupola*.

The *spiral tube* passes round the modiolus, making two turns and a half from the base to the apex, and gradually decreasing in capacity.

The SPIRAL LAMINA (septum scalæ, lamina spiralis). Arises from the vestibule, and winds round the modiolus within the spiral tube. Its greatest breadth is at its origin, and gradually becomes narrower towards the apex of the cochlea. It is composed of two extremely thin plates of bone, united at the margin, from which a membranous substance *(zona cochleæ)* is reflected on each side. The termination of the lamina forms a *hamulus*, or small hook, projecting into the infundibulum. By the aid of the membrane, the lamina makes a complete septum, and divides the spiral tube into two canals, or gyri, one of which is called the scala tympani, from its having an aspect towards the tympanum; the other, the scala vestibuli, from its communication with the vestibule.

The SCALA TYMPANI is nearer the base of the cochlea, and begins from the fenestra rotunda; but does not communicate with the tympanum, the aperture being shut by a membrane.

The SCALA VESTIBÛLI begins by an oval orifice, between the fenestra ovalis and the ampulla of the vertical canal. The scalæ run parallel with each other, and communicate only at the apex of the cochlea.

The AQUÆDUCTUS COCHLEÆ is a minute canal, which begins at the under part of the scala tympani, near the fenestra rotunda. It ascends, becomes larger, and terminates by a triangular opening upon the surface of the dura mater, between the passage of the seventh and eighth pairs of nerves.

CHAPTER VII.

Of Parts about the Chest and Upper Extremities.

§ 1. CAVITY OF THE CHEST.

The *diaphragm* is a plane of muscular fibres, which, together with its middle tendon, constitutes the separation between the thorax and abdomen. It is formed into a vault, rising up from its inferior attachments as high as the level of the fourth rib, in consequence of which it is applied closely to the lower ribs. Its anterior attachments are considerably higher than the posterior; so that the capacity of the chest, with respect to height, is considerably greater at the back than at the fore part, and the lungs at that part sink down behind the abdominal viscera.

The *upper end* of the chest forms an opening, contracted from the conical figure of the cavity. It is occupied laterally by the upper ends of the pleura and lungs, which rise a little above the level of the first rib. Several important parts pass through it, the description of which has been already given, included in that of the lower parts of the neck. In order to examine completely their relative position, the head may be separated from the trunk, between the fourth and fifth cervical vertebræ.

SITUATION OF THE LARGE VESSELS. Behind the upper part of the sternum are situated the large vessels immediately connected with the heart. On raising the sternum, the left subclavian vein will be seen after its junction with the internal jugular, taking its course obliquely downwards to the right side to form with the opposite subclavian the vena cava superior, and crossing the great arteries from the arch of the aorta, which is situated somewhat below and behind the vein, and as it passes to the left side crosses the trachea, just before its bifurcation into the bronchia.

§ 2. OF THE AXILLA.

In order to understand the connexion of the lower and lateral parts of the neck with the axilla, as well as the course of the vessels and nerves between them and within the latter, it will be proper to begin the dissection on the fore part: raising that portion of the pectoralis major which arises from the clavicle, covers the space, and conceals the parts which are to be displayed. A view of the important parts may thus be gained through a triangular space formed by the clavicle above; by the edge of the deltoid muscle to the outer side, and to the inner side by the edge of the sternal portion of the pectoralis major. Having elevated the shoulder somewhat with the elbow close to the side so as to relax somewhat the pectoral muscle, we then prosecute the dissection between the deltoid and pectoral muscles, turning the latter carefully on one side. At this part the *cephalic vein* takes its course, between these muscles and behind the pectoralis towards the axillary vein, and the *humeral thoracic artery* is seen winding up to the deltoides. Deeper than the above-mentioned muscles, the space is circumscribed by the subclavius and pectoralis minor muscles above and below, but retaining the same lateral boundaries. Superiorly, it is crossed by a *ligamentous production* from the under part of the clavicle to the root of the coracoid process. Posteriorly, at the edge of the pectoralis minor, and partly covered by it, the *axillary vein* will be seen passing outwards and downwards: and above, behind, and partly hid by the vein, the *axillary artery*, taking the same course. The *axillary plexus* is situated still more posteriorly; part above, and part hidden by the artery. The relative position of these parts will be altered by the state of the shoulder:—If elevated, the pectoralis major becomes relaxed, and the space of the artery will be more exposed.—[If too much elevated the pectoralis minor becomes stretched.]—If the shoulder be depressed, the space will be straightened from side to side.

The axilla may be considered as a pyramidal cavity, the sides of which are formed by the pectoralis major and minor on the fore part, by the scapula, subscapularis, and latissimus dorsi on the back part, by the ribs and serratus magnus to the inner side; its apex being the coracoid process, and its base determined by the edges of the pectoralis major and latissimus dorsi. The cavity is occupied by blood-vessels, nerves, and absorbent glands, embedded in fat and cellular membrane. The view of the contained parts must be gained from below. For this purpose, the arm is to be turned up towards the side of the head; the triangular form of the base will then become apparent, the pectoralis major and latissimus dorsi muscles having been put on the stretch. The dissection is then to be begun at the edge of the pectoralis major. On removing the fat and cellular membrane, some *superficial nerves* and *absorbent glands* will be displayed. The *axillary vein* will then be seen mounting upwards and outwards from under the edge of the pectoral muscle. Above it is the *axillary artery*, which, nearer to the os humeri, is covered by the axillary plexus, and then becomes situated close to the head of the bone. Before it has passed the plexus, the artery is behind the edge of the pectoralis minor, and afterward opposite to the head of the humeral bone. If the arm be brought to the side, these important parts become placed behind the pectoralis major. The course of the *thoracic* and *subscapular arteries*, with their *accompanying veins*, should be examined. Other *absorbent glands* will be found in different parts of the cavity.

The *axillary artery* in its course through the axilla, has been described, p. 214.

(Practical Points.)—Compression of the axillary artery.—Taking up the artery below the clavicle.—Amputation at the shoulder-joint.—Removal of steotomatous and other tumours from the hollow of the axilla.—Extirpation of diseased glands.—Ascertaining enlargement of the axillary glands in scirrhous breast.

CHAPTER VIII.

Of Parts about the Pelvis and Lower Extremity.

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§ 1. REMARKS ON THE BONY STRUCTURE OF THE PELVIS.

BEFORE the dissection of the parts situated within and about the pelvis, it is proper to take a review of its bony structure. Without an accurate knowledge of its form, dimensions, and relative position, as well as the situation and size of its openings, no just idea can be formed of the relative position of the organs contained within, of the manner in which they are protected from external injury, or of the modes of access to them.

The pelvis is of a symmetrical figure, a verbal description of which, however, is scarcely practicable. Its *upper part* forms an oval cavity, which is rendered more capacious laterally by the hollows of the ilia. It communicates by an *oval-like opening* [the upper opening of the pelvis] with the *inferior cavity,* a kind of canal, large in the middle, and contracted at its extremities, the inferior of which forms an opening called the *outlet of the pelvis*. It is in this inferior cavity, that the pelvic viscera are chiefly contained; the relation of which to the outlet [or inferior opening of the pelvis] is the point of the most practical importance. The *axis of the pelvis,* or a line which is carried through the middle of the inferior cavity, forms a considerable angle with the axis of the spine; so that when the body is in the erect posture the anterior and superior spinous processes of the ilia, and the most prominent point of the pubes, are nearly in the same perpendicular plane; the sacrum and posterior parts of the ilia become proportionably elevated; the superior opening faces upwards and forwards; and the outlet is turned downward and backward. In sitting, the body is supported on the anterior part of the tuberosities of the ischia. But in the different postures of the body, the relation of the axis of the pelvis to that of the vertebral column becomes considerably altered.—In the horizontal posture the angle is more acute, and when the thighs are completely bent upon the trunk, as in placing a patient for the operation of lithotomy, the line of the axis of the pelvis and that of the trunk will nearly coincide. It is to be borne in mind that the position of the pelvic viscera will partake in these changes of posture.

The *outlet of the pelvis* is occupied in both sexes by a part of the genital organs. It forms three eminences and three depressions. The eminences are the two tuberosities of the ischia on the fore part, and the os coccygis behind, which does not descend nearly so low as the other eminences from circumstances that have been already explained. Of the depressions—one, the arch of the pubes, is situated anteriorly: the other two depressions are comprehended between the ilia, ischia, sacrum, and the os coccygis; the two sacro-sciatic ligaments divide each into three parts,—a superior, through which the pyramidalis muscle and the sciatic, pudic, and gluteal vessels and nerves pass—a middle, smaller than the first, for the passage of the tendon of the obturator internus and the pudic vessels and nerves—and an inferior part containing chiefly the fat and cellular membrane surrounding the extremity of the rectum.

The *organs contained within the pelvis* are protected by the peculiar form and disposition of the bones, assisted at the sides by the thick muscles at that part, and the parts of the femoral bones about their articulation, especially the trochanters; at the back part by the muscular mass attached to it and by the posterior projections of the ilia.

The *dimensions of the pelvis* in the male are greater in a perpendicular direction than those in the female; as may be seen in the measurement of the distance between the tuberosity of the ischium and the brim of the pelvis or anterior and superior spinous process of the ilium, &c. In the female on the contrary the horizontal dimensions are greater; thus the cristæ of the ilia, the tuberosities of the ischia, &c. are more widely separated, the distance is greater between the sacrum or sacro-iliac symphysis and pubes, &c., and the angle of the arch of the pubes is more obtuse.

§ 2. OF THE PARTS OF INGUINAL HERNIA.

The *parts concerned in inguinal hernia* (which are next to be described) are chiefly the spermatic cord and the parts connected with it in its passage from the abdomen to the scrotum.

The relative position of these parts will be best seen if the contents of the abdomen have been removed without injuring the lower portions of the abdominal muscles.

The dissection is to be begun by making an incision upwards in the course of the linea alba, from the pubes to a point opposite the anterior and superior spinous process of the ilium, and another transversely to meet it from that process; the integuments are then to be turned back as far as the groin: this will bring into view a layer of that kind of cellular membrane before described, which has been named the *aponeurosis of the external oblique;* in tracing it downwards it will be observed to extend over the groin, and to adapt itself to the spermatic cord in passing down upon it, and if a blow-pipe be inserted under it at that part, the air thrown in will be found to raise it to the lower part of the testis.

In order to display the *lower portion of the external oblique muscle*, a flap of the aponeurosis, like that of the integuments, is to be dissected back, as low down as *Poupart's ligament*, which is a portion of the tendon of the external oblique muscle, stretched between the *spinous process of the os pubis* and the *anterior superior spinous process* of the ilium. The edge which it forms at this part is, however, indistinct, as will be hereafter explained. Above, and a little to the outer side of the spinous process of the os pubis, the fibres of the tendon of the external oblique, interlaced as it were by other tendinous fibres, separate to form an opening which is called the *abdominal ring*, or to distinguish it from another opening presently to be spoken of, the *external* abdominal ring; it is, however, neither round, nor does it seem an opening, being occupied in some measure by cellular membrane. Through it the *spermatic cord* in the male, and the *round ligament* in the female pass from the parietes of the abdomen to the scrotum, becoming invested at this part as before described by the aponeurosis of the external oblique.

The next part of the dissection consists in tracing the oblique course of the cord from its quitting the abdomen to the part where it appears externally. It is to be done by carrying an incision from a little above the external abdominal ring, in a somewhat semicircular direction outwards to opposite and near the anterior superior spinous process of the ilium. Detaching then the tendon from the parts behind, above and below, the lowest fibres of the *internal oblique* will be seen, particularly those which pass from the outer half of Poupart's ligament to the pubes, being however neither strong nor numerous. Beneath the under edge of the internal oblique the spermatic cord passes obliquely to the external opening, acquiring here a part of its muscular covering, some of the fibres of the *cremaster muscle* being given off from the internal oblique. An incision through the internal, like that through the external oblique, shews the *transversalis muscle* disposed much in the same way as the internal oblique, its fibres few and weak, where arising from Poupart's figament, and becoming tendinous towards the pubes behind the external opening. The rest of the cremaster not furnished by the internal oblique is derived from the transversalis. It will be evident from the foregoing description, that if a blunt instrument be passed through the external abdominal ring, it will be prevented from passing into the abdomen by the interposition of the tendon of the transversalis muscle. The fibres of the transversalis are now to be cautiously raised, beginning near to the spinous process of the ilium, and cutting through the cremaster: a *fascia* will then be found to line its posterior surface, composed of two portions; that on the outer side of the spermatic cord is of considerable thickness near to the ilium. That on the inner side of the cord springs from the pubes, descends behind Poupart's ligament on the femoral vessels, and is slightly attached to Poupart's ligament: and these form the *fascia transversalis.* In tracing the spermatic cord towards the abdomen, it seems to disappear about midway between the spinous process of the pubes and the ilium; by insinuating a blunt instrument along the cord, and detaching the cellular membrane from around it, it will be found to pass through an opening in the fascia above described, which has been called the *internal abdominal ring.* This opening is lined posteriorly by the peritonæum, and it is here that the spermatic cord is formed, the vas deferens passing down into the pelvis, whilst the spermatic vessels and nerves are derived from above.

The relation then of the internal abdominal ring to the external opening, is that whilst the latter is situated at the spinous process of the pubes, the former is placed midway between the spinous process of the pubes and the anterior superior spinous process of the ilium, at the distance of an inch and a half from it, and above a line which is drawn from the top of the external opening horizontally outwards. The space between the two openings is called the *inguinal canal.* Consequently the *direction of the spermatic cord* within the canal will be inwards, downwards, and somewhat forwards; in its course passing under the edge of the internal oblique and of the transversalis muscle, deriving from these its muscular covering, the cremaster, and receiving after it has passed the external opening, a further covering from the aponeurosis of the external oblique.

The *epigastric artery,* in taking its course from its origin at the external iliac, inwards and upwards to the rectus, is situated a little to the inner side of the internal ring, and is placed behind, and to the inner side of the cord, crossing it at a right angle.

OF THE PARTS OF INGUINAL HERNIA IN THE FEMALE.

In the female the *round ligament* occupies the place of the spermatic cord of the male in the inguinal canal. From being smaller the parts through which it passes are more contracted but are better seen and more easily developed than in the male.

(Practical Points). The reduction of inguinal hernia—The adaptation of trusses—The operation for strangulated inguinal hernia.

§ 3. OF THE PARTS OF CRURAL HERNIA.

The *parts concerned in crural hernia* are chiefly those which are connected with the passage of the vessels at the groin.

The study of this part of anatomy should be begun by examining the manner in which the thigh is separated from the abdomen; and, at the same time, the mode in which they communicate. The peritonæum is to be removed from the lower part of the abdomen; then behind and below Poupart's ligament (which has received the name of the *crural arch*) the *opening* may be perceived by which the iliac vessels are passing from the posterior part of the abdomen to the upper and anterior part of the thigh. This opening is chiefly occupied by the *femoral artery*, and on its pubic side by the *femoral vein;* to the inner side of the vein one or more *absorbent glands* will be found. The space around the opening between the body of the os pubis and Poupart's ligament is filled up:—*Behind,* by the *psoas* and *iliacus muscles* and the fascia covering them. This, the *fascia iliaca,* is attached to the inner labium of the crista of the ilium, extends behind the iliac vessels, and to the inner side of these is attached to the linea ilio-pectinea; it is found particularly firm where assisting to shut up the abdomen at the outer part of the iliac vessels behind the crural arch, and sends a *portion with the femoral vessels* into the thigh:—*Before,* by the *fascia transversalis,* which has been already spoken of as forming the internal abdominal ring, in describing the parts connected with inguinal hernia. After lining the posterior part of the abdominal muscles, and being closely attached to the crural arch, it unites on the outer side with the fascia iliaca between the anterior superior spinous process of the ilium, and the iliac vessels, the place of their junction being marked by a white line; on the inner it extends to the pubes, but becomes thinner and less distinct, and it sends out a *process* which descends behind the crural arch and passes before the femoral vessels into the thigh. The portion of the fascia iliaca which passes with the femoral vessels from behind, and the portion of the fascia transversalis which passes with them from before, seem by their union at the sides to form the *femoral sheath;* this at the beginning is of a funnel shape, but is flattened from before to behind, and it becomes contracted a little below the crural arch.

By detaching the sheath from its connexions on the pubic side, it will be found that to the inner side the space behind the crural arch is narrowed by a horizontal portion of tendon of a triangular figure, extending from the arch to the opposite part of the os pubis, and presenting a sharp edge towards the femoral vein: it is called *Gimbernat's ligament,* or the third insertion of the external oblique muscle.

The dissection is to be prosecuted by examining the relation and connexion of these parts with those situated *externally.* After removing the integuments, that which has been called the *aponeurosis of the external oblique* may be traced extending over the groin, and descending upon the thigh: it covers the *inguinal glands,* which are clustered together at this part, and portions of it are dipping in between them. The aponeurosis may now be dissected back to display the *fascia lata,* which will be seen attached to *Poupart's ligament,* rendering its rounded edge indistinct. But the fascia lata may be said to be composed of two portions at the upper part:—an outer and more dense one attached to nearly the whole extent of Poupart's ligament, which covers the muscles at the fore part of the thigh, and in a great measure the femoral vessels, but terminates upon them in a more or less distinct *crescent-shaped edge* (sometimes called the falciform process);—and an inner, deeper seated and thinner portion attached to the pubes and its ligament, which covers the muscles at the inner part of the thigh, seems to pass behind the femoral vessels, and unites with the outer portion some little way below the crural arch. Through this *opening of the fascia lata,* thus formed by its two portions, a part of the sheath of the femoral vessels may be perceived; and the *vena saphæna major,* which rises up from the inner part of the thigh, and may be traced to its termination at the femoral vein. When the absorbent glands are removed which are seated about this part, the inner side of the femoral sheath will be found to have numerous perforations; this *cribriform structure* allows of the communication between the inguinal absorbent glands and those situated within the sheath, but renders the fascia forming the sheath weaker at this part. The fascia lata being removed, the crural sheath appears, which contains the femoral artery and vein separated from each other by a tendinous septum; the absorbent vessels entering the inner and upper part of the sheath. The *anterior crural nerve* is situated upon the muscles on the iliac side of the sheath, but the trunk of this nerve does not enter the crural sheath.

(Practical Points.) The reduction of crural hernia—The adaptation of trusses—The operation for strangulated crural hernia.

§ 4. OF THE OUTLET OF THE PELVIS.

Some *parts situated at the outlet of the pelvis* are next to be considered; not noticed in the description of the male organs of generation. The integuments are first to be carefully raised in that part of the perineum before the anus, which is bounded laterally by the rami of the ischia and pubes. A layer of *aponeurosis*, more or less distinct, will come into view, of the same kind as has been already described.—In tracing its extent it will be found attached to the rami of the pubes and ischia; and if a blow-pipe be inserted under it, the air thrown in will insinuate itself through the cellular membrane of the scrotum as far as the groins, shewing its connexion with the aponeurosis of the external oblique. This, together with the fat occupying the space, is to be removed, and the *muscles of the perineum* may be dissected. The *arteria perinei*, a branch of the internal pudendal, will be seen entering the perineum between the sphincter ani and erector penis; it continues its course between the bulb and crus of the penis towards the scrotum, to which it is distributed, giving branches to the accelerator urinæ, erector penis, sphincter ani, and cellular substance of the perineum.

By separating the bulb and crus of the penis, and removing the acceleratores urinæ, it will be found that the triangular space formed by the rami of the ischia and pubes is occupied by a *ligamentous septum* attached to them, to which the *bulb of the penis* is firmly bound down, and through which the urethra, where it forms its membranous part, passes.

The dissection is to be continued in the space behind the anus and tuberosities of the ischia, which is bounded behind by the os coccygis, and laterally by the edges of the glutæi maximi muscles, that pass from the os coccygis behind the tuberosities of the ischia. The *extremity of the rectum* is situated in the middle of the perineal space between the posterior parts of the tuberosities of the ischia; surrounded by the *sphincter ani*. A considerable quantity of fat is to be removed from the space betwixt the glutæi and sphincter ani muscles; the *posterior fibres of the levator ani* muscle then come into view, and the manner in which this part of the outlet is shut up may be observed.—The posterior fibres of the levator ani will be seen directed from before obliquely backward, and attached to the os coccygis; but united, between it and the sphincter ani, by the meeting of the fibres from the opposite sides. Connecting the fibres of that muscle and apparently attached to the *posterior sacro-sciatic ligament*, which is situated above the edge of the glutæus maximus, is a *dense membranous structure* which assists in supporting and defending the pelvic viscera.

§ 5. OF THE CAVITY OF THE PELVIS.

In order to complete the knowledge of the disposition and connexion of the contents of the pelvis [of which the best general idea is gained by the side-view of the pelvic viscera, which the student is supposed to have made himself master of—] the dissection may be varied and may be begun from behind.

The glutæi muscles are to be raised at the back part, and the whole posterior part of the pelvis is to be laid bare. A perpendicular section of the pelvis is then to be made by cutting through the ilia from their cristæ into the upper part of the ischiadic notch; the rectum cut through about three inches above the anus; and the upper portion, together with the sacrum, removed. By thus laying bare the cavity of the pelvis, the relative situation of its contents may be examined without that displacement which some of them undergo if the side view of the pelvis be taken. The form and situation of the *urinary bladder* will be well displayed, especially if it be inflated to about half its capacity, and the *peritonæum* will be observed to cover its posterior surface, and afterwards to turn upon the anterior and inferior part of the *rectum*. It is to be carefully dissected from the gut, and will be seen to leave it at the base of the vesiculæ seminales, but to be attached some little way downwards between them, ending in a semicircular line, the convexity of which is anteriorly. Proceeding with the dissection between the bladder and rectum, the *vesiculæ seminales* are to be cleaned, without detaching them from their situation, and the space is to be examined which is formed between them by the attachment of the peritonæum behind and laterally by the vasa deferentia, placed to the inner side of the vesiculæ seminales. *A triangular portion of the bladder* is thus circumscribed, between which and the rectum only a small quantity of cellular substance is interposed. The apex of this triangle is situated about two inches higher than the verge of the anus, the prostate being unenlarged. At the neck of the bladder the *prostate gland* is placed, directly above the junction of the accelerators urinæ with the sphincter ani. Its extent may be felt by passing the finger up the rectum, and it is displayed by turning on each side the levatores ani at that part. From the prostate the *membranous part of the urethra* passes under the arch of the pubes. At this part besides the *anterior fibres of the levatores ani,* processes of *dense cellular membrane* assist in shutting up the cavity of the pelvis.

It will be understood from the foregoing description, that the *urethra,* between the posterior part of the bulb (which is connected with the ligamentous septum of the perineum) and its commencement at the bladder, is fixed, from passing through parts which do not admit of motion. Likewise between the bulb and its commencement it makes a considerable curve, rising upwards for the space of two inches. Its relation to the arch of the pubes will, however, be altered in proportion as the axis of the pelvis becomes parallel with that of the vertebral column.

(*Practical Points.*) Passing the catheter—Puncturing the bladder from the rectum or perineum—Abscess in perineo—Course of pus—Fistula in perineo—Operation for fistula in ano—Enlarged prostate—Lithotomy.

§ 6. OF THE POPLITEAL SPACE.

At the bend of the knee posteriorly, having dissected back the integuments, an *aponeurosis* (such as has been before described) must be cut through in order to display the *fascia lata,* which will be found thin at this part. From the separation of the muscles, a *hollow* is formed at this part, of a triangular figure; it is bounded by the *semi-membranosus* and *semi-tendinosus* at the inner side, by the *biceps cruris* muscle at the outer. This diverging of the flexors of the leg may be observed in the living body, and the prominences which they form have been vulgarly called the ham-strings. The triangular space above described is lengthened below by the separation between the heads of the *gastrocnemii muscles,* both of which are received between the inferior extremities of the flexors. Some of the fat which fills the bend of the joint having been removed, the *posterior crural nerve* will be seen at the upper part to divide into the *posterior tibial* and *peroneal nerves;* the first descending nearly vertically, the latter taking the course of the biceps. Prosecuting the dissection by penetrating deeper than the posterior tibial nerve, a little to its inner side, and partly covered by it, we find the *popliteal vein,* and still deeper seated in some degree to the inner side of the vein, the *popliteal artery.* Considerable *branches* are given off by the artery, the *articular, surales,* &c. The *saphæna minor vein* and many *twigs of nerves* are likewise found in this space.

The *edge of the semi-membranosus* forms the direction for an incision down to the popliteal artery.

The *course of the popliteal artery* is obliquely downwards and outwards. It begins, as before described, at the upper part of the lowest third of the thigh, and terminates at the lower part of the uppermost fourth of the leg. Its relative position has been already described, p. 273.

(Practical Points). Popliteal aneurism—The operation of taking up the popliteal artery.

THE END.

J. M'Creery, Printer,
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A.A. *Erector Penis*

B.B. *Accelerator Urinæ*

C.C. *Transversus perinei*

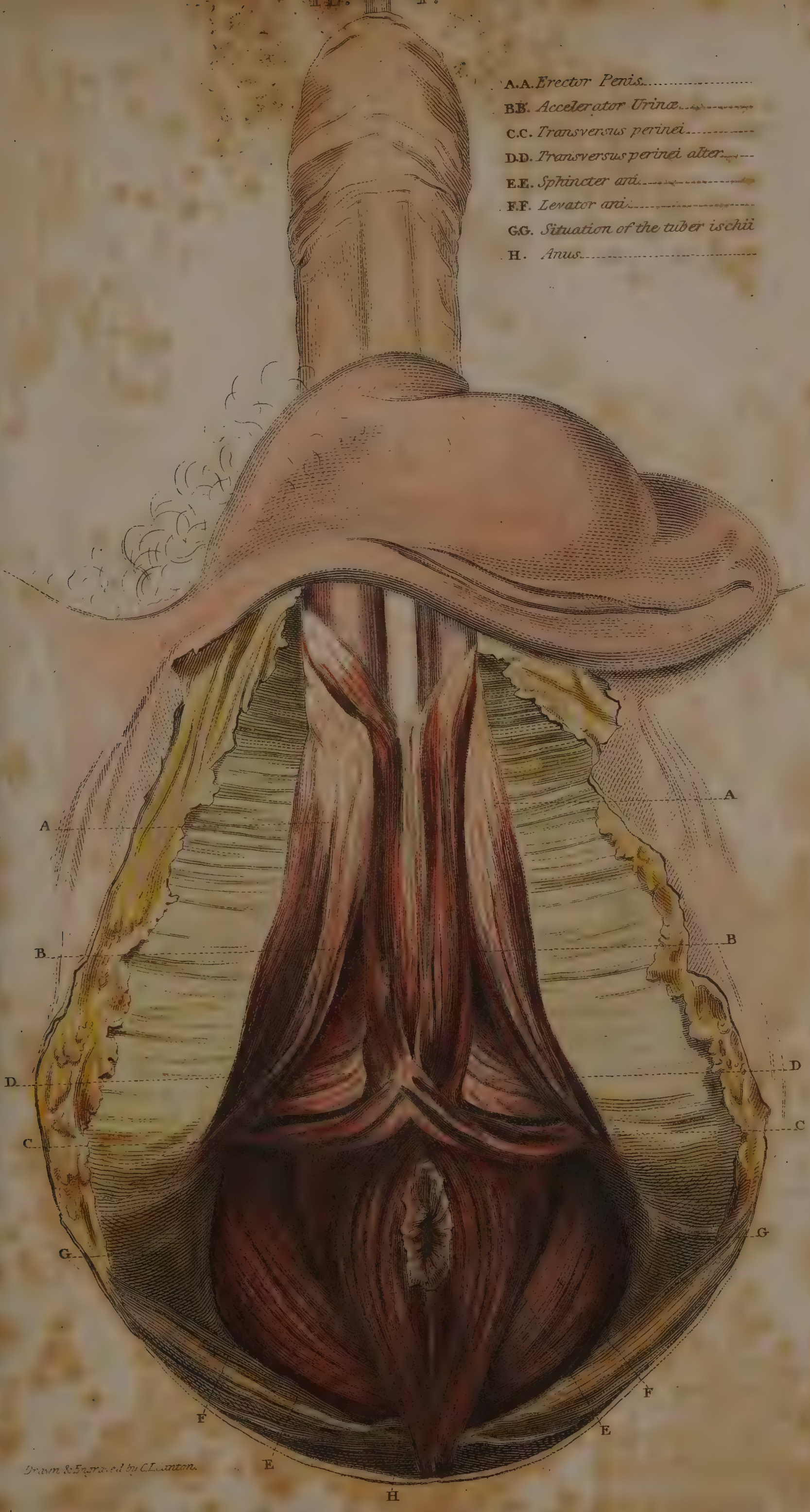
D.D. *Transversus perinei alter*

E.E. *Sphincter ani*

F.F. *Levator ani*

G.G. *Situation of the tuber ischii*

H. *Anus*



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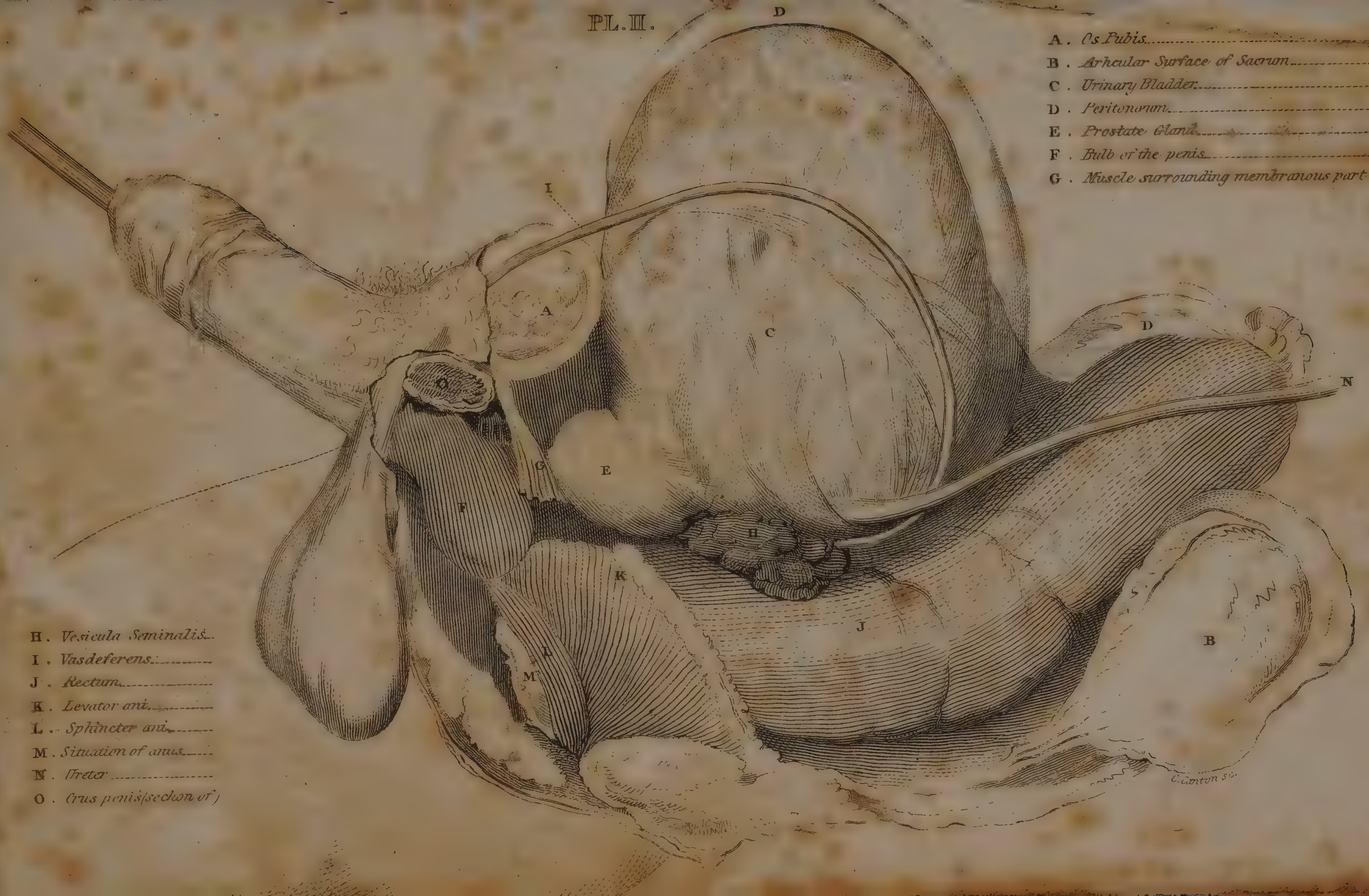
PL. III.

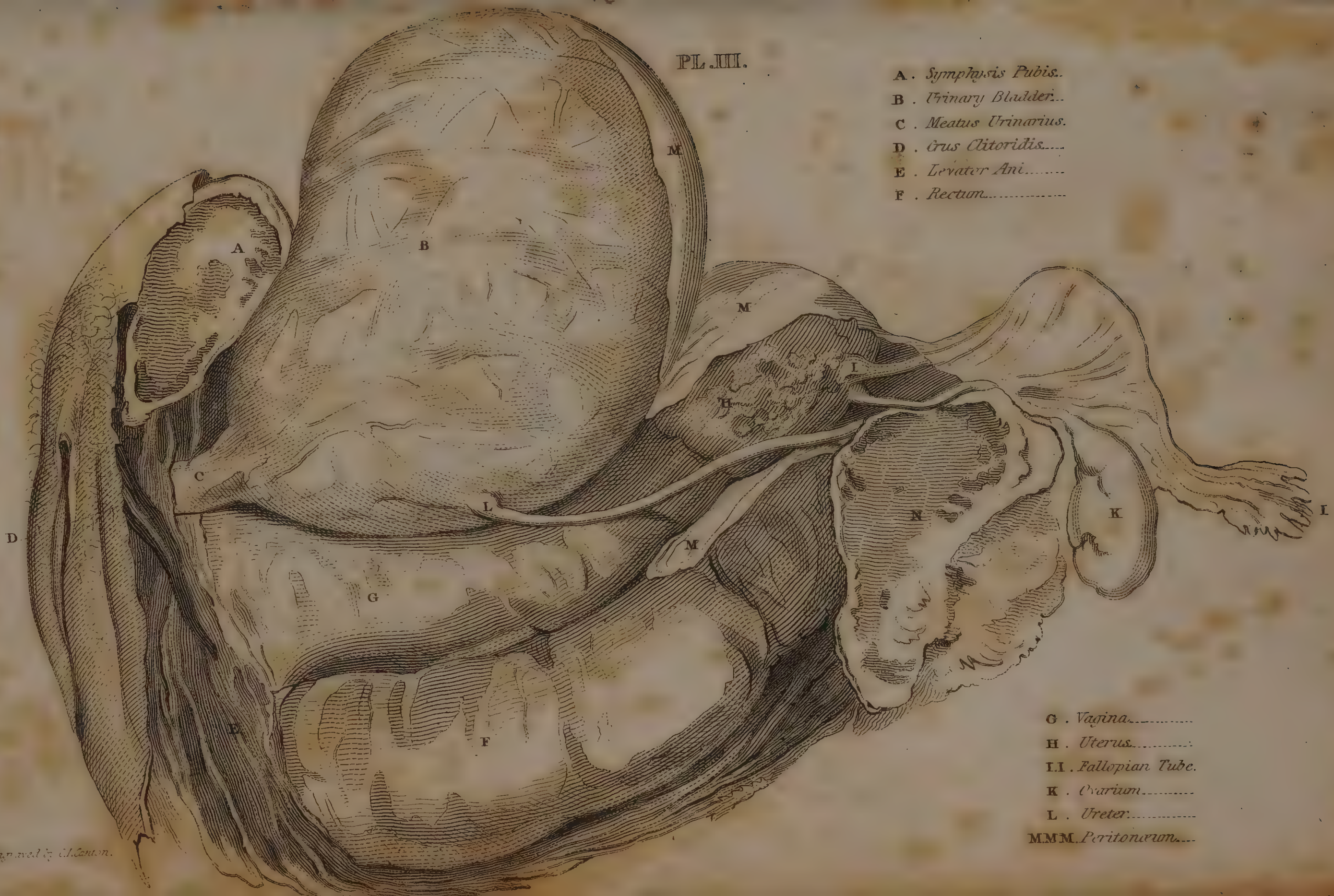


A. *Os Pubis*
B. *Articular Surface of Sacrum*
C. *Urinary Bladder*
D. *Peritonæum*
E. *Prostate Gland*
F. *Bulb of the penis*
G. *Muscle surrounding membranous part of urethra.*

H. *Vesicula Seminalis*
I. *Vasdeferens*
J. *Rectum*
K. *Levator ani*
L. *Sphincter ani*
M. *Situation of anus*
N. *Ureter*
O. *Crus penis (section of)*

PL. III.

A . *Symphysis Pubis.*
B . *Urinary Bladder.*
C . *Meatus Urinarius.*
D . *Crus Clitoridis.*
E . *Levator Ani.*
F . *Rectum.*



G . *Vagina.*
H . *Uterus.*
I.I . *Fallopian Tube.*
K . *Ovarium.*
L . *Ureter.*
MMM. *Peritonæum.*

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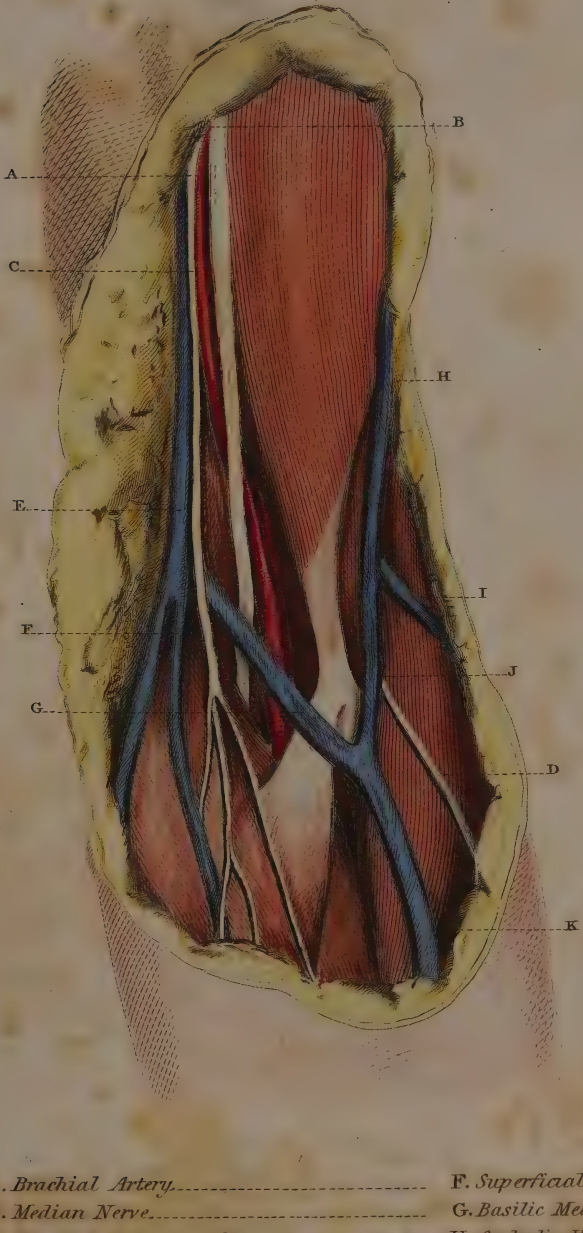
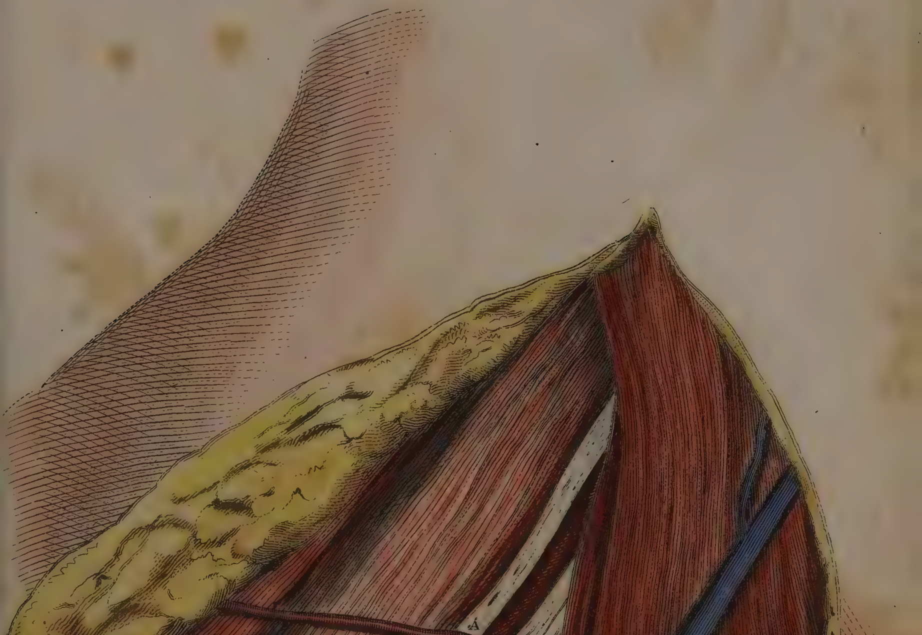


A. *Brachial Artery*	F. *Superficial Ulnar Veins.*
B. *Median Nerve*	G. *Basilic Median Vein*
C. *Internal Cutaneous Nerve*	H. *Cephalic Vein*
D. *Branch of the External Cutaneous Nerve.*	I. *Superficial Radial Vein.*
E. *Basilic Vein*	J. *Cephalic Median Vein*

K. *Common Median Vein.*

J.H.G. del. C. Canton Sculp.

PL.V.



A.A.A. *Nerves of the axillary plexus.*

B . *Subclavian artery*

C . *Subclavian Vein*

D . *Posterior cervical artery*

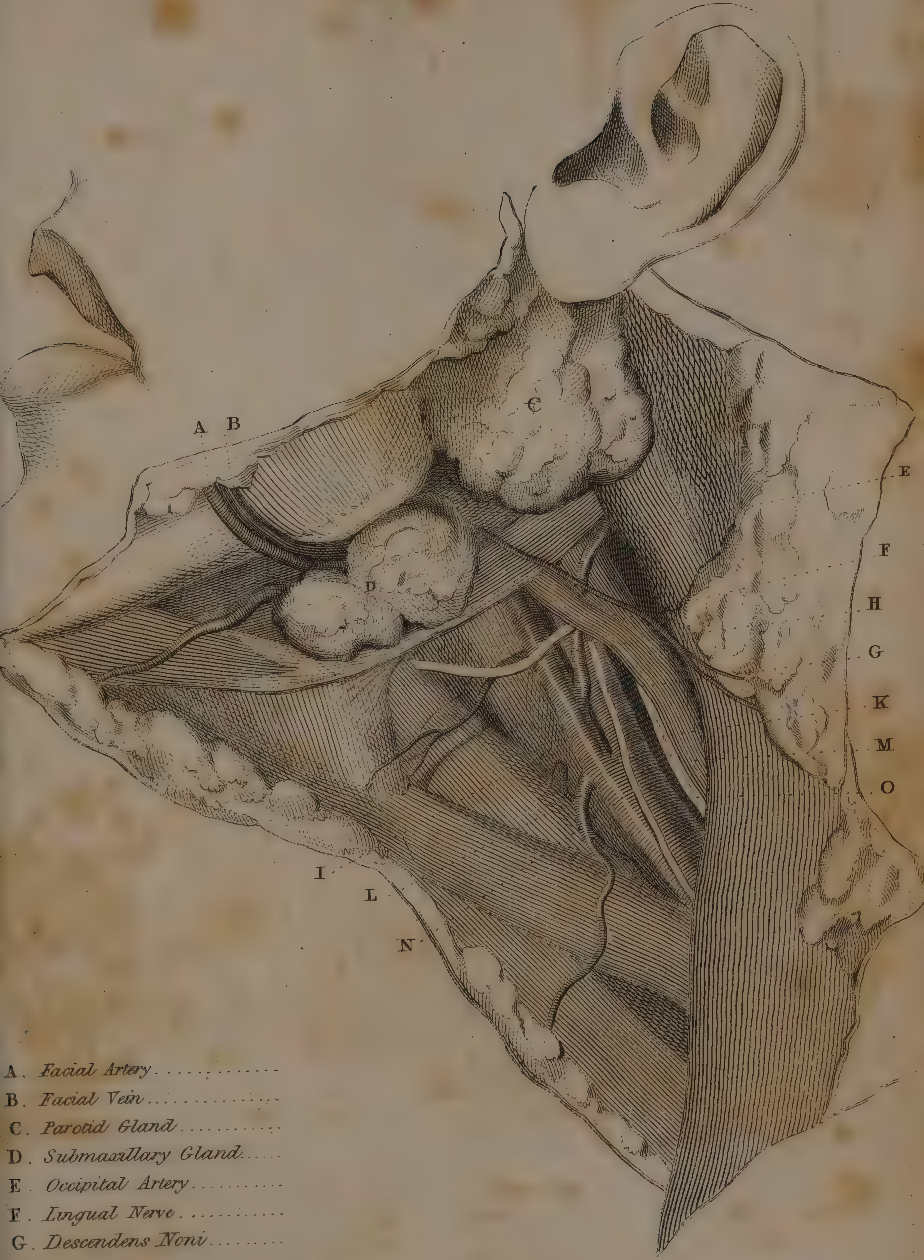
E . *Omo-hyoideus muscle*

F . *Sterno-cleido mastoideus*

G . *Scalenus anticus*

H . *External Jugular Vein*

PL. VI



A. *Facial Artery*

B. *Facial Vein*

C. *Parotid Gland*

D. *Submaxillary Gland*

E. *Occipital Artery*

F. *Lingual Nerve*

G. *Descendens Noni*

H. *Lingual Artery*

I. *External Carotid Artery*

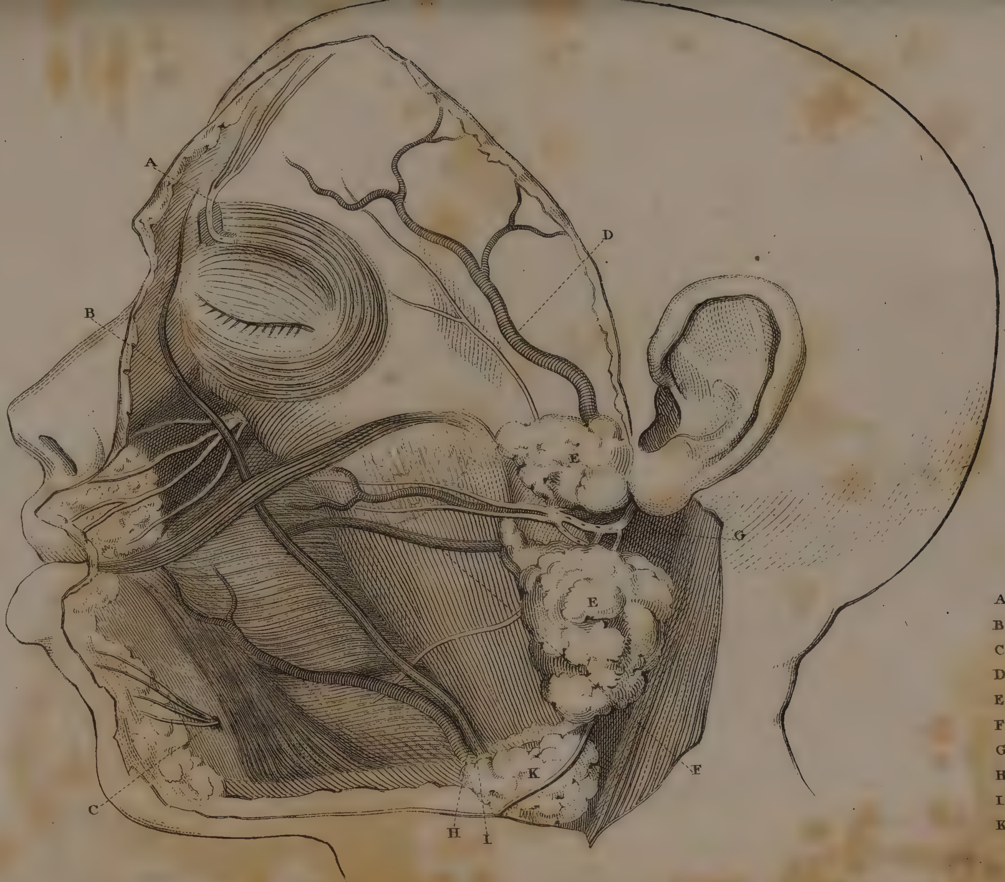
K. *Internal Carotid Artery*

L. *Sup: Thyroideal Artery*

M. *Internal Jugular Vein*

N. *Common Carotid Artery*

O. *Pneumo-gastric Nerve*



A . *Supra orbitar nerve*

B . *Infra orbitar nerve*

C . *Dental Nerve*

D . *Temporal artery*

EE. *Parotid Gland*

F . *Duct of the parotid gland.*

G . *Facial nerve*

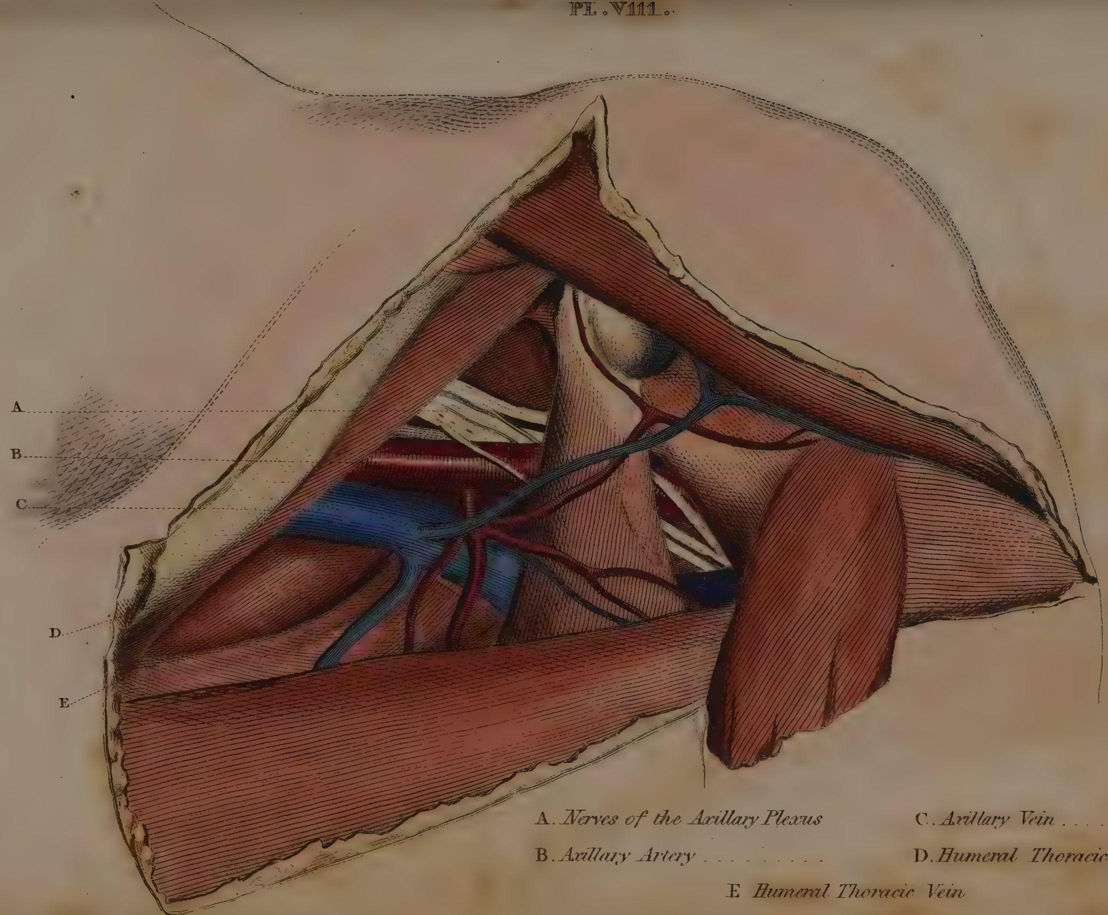
H . *Facial artery*

I . *Facial Vein*

K . *Submaxillary gland.*

J.H.S. del.t

PL. VIII.



A. *Nerves of the Axillary Plexus*

B. *Axillary Artery*

C. *Axillary Vein*

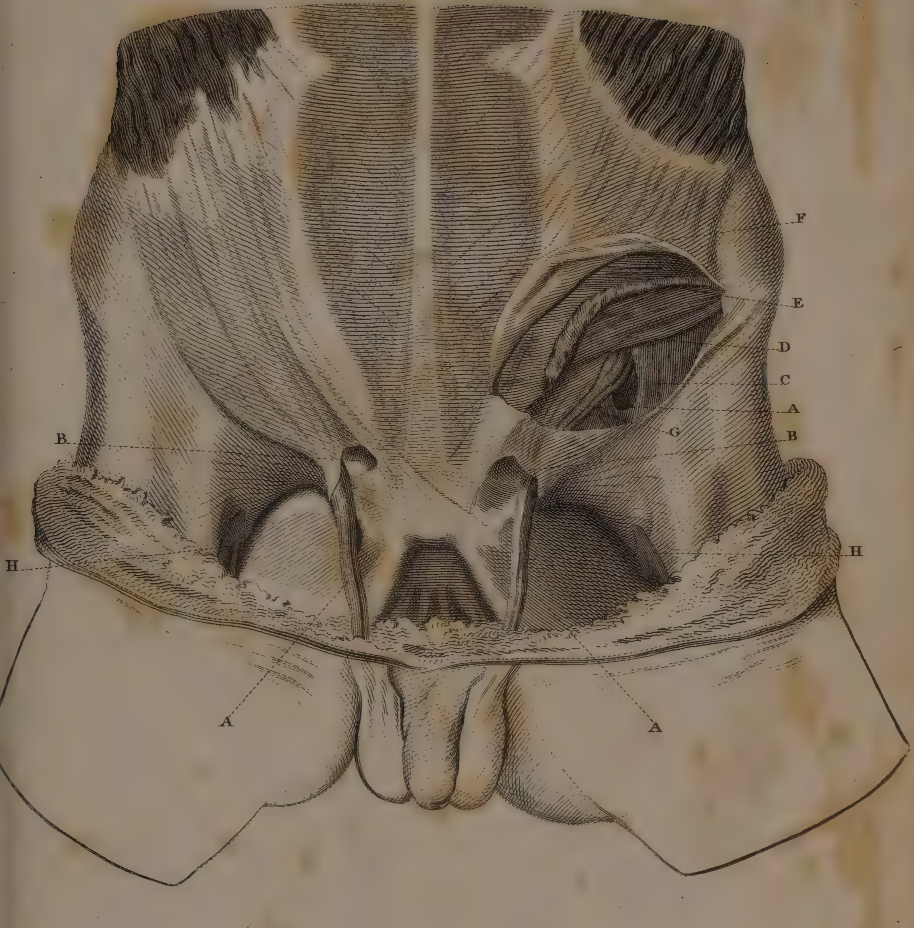
D. *Humeral Thoracic Artery*

E *Humeral Thoracic Vein*

J. H. G. Del.

C. Canton Sculp^t.

PL.IX.



A.A.A. *Spermatic cord*

B.B. *Abdominal rings*

C . *Fascia Transversalis & Internal abdominal ring*

D . *Transversalis muscle*

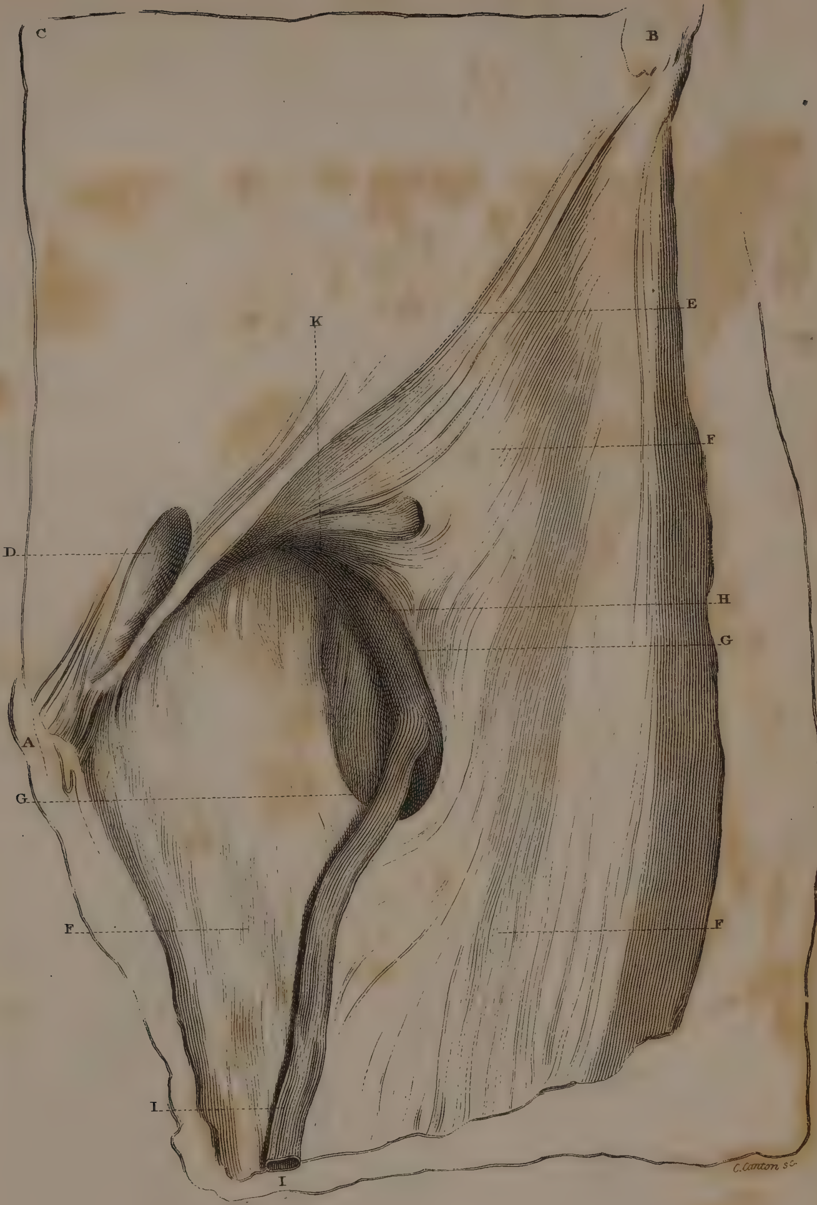
E . *Internal oblique muscle*

F . *Tendon of the external oblique muscle cut open.*

G . *Epigastric artery and vein*

HH *Saphæna major vein of the Leg*

J.C.Canton Sculp^{t}

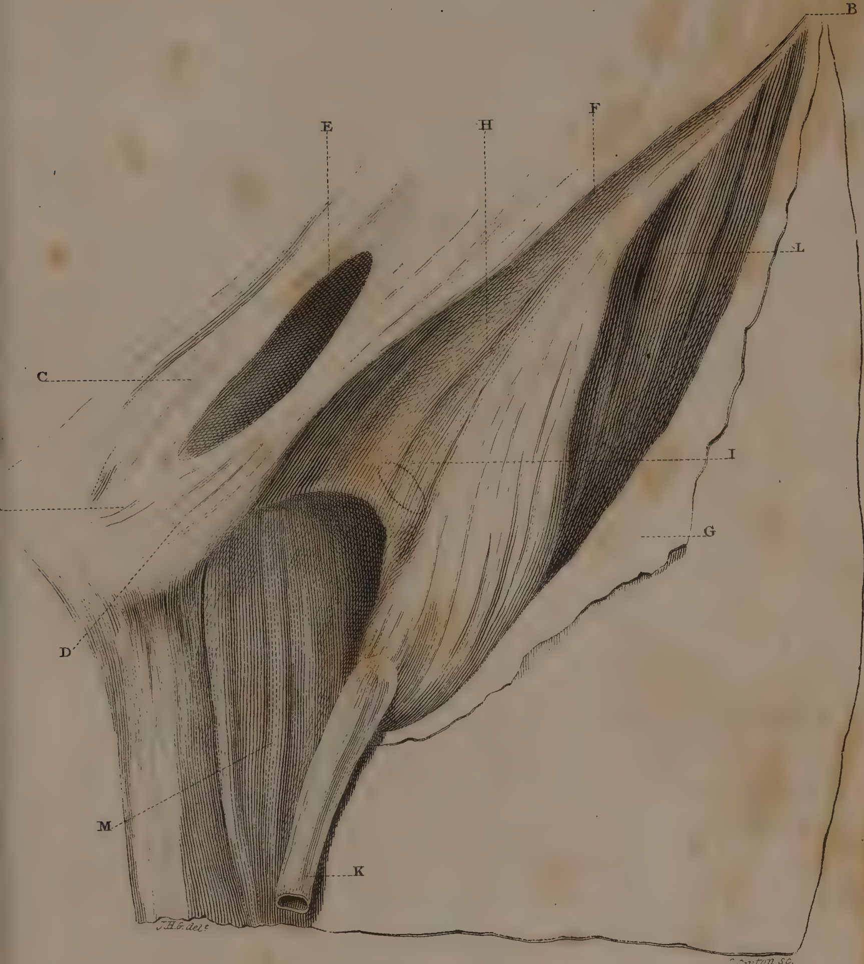


A. *Symphysis pubis.*
B. *Spinous process of the ilium.*
C. *Abdominal muscles.*
D. *Abdominal ring.*
E. *Crural arch.*

F.F.F. *Fascia lata of the thigh.*
G.G. *Semilunar edge of the fascia lata.*
H. *Crural sheath or fascia enclosing the crural vessels.*
I. *Saphœna major vein.*

K. *Place at which the crural hernia descends.*

PL. XI.



J.H.G. delt

C Canton sc.

A. *Pubis.*

B. *Ilium.*

C. *Superior column of the abdominal ring.*

D. *Inferior column.*

E. *Abdominal ring.*

F. *Anterior edge of the crural arch, or Poupart's ligament.*

G. *Fascia lata dissected from the crural arch and turned back.*

H *Third insertion of the external oblique into the ligament of the pubis, to see which the facia lata & the origin of the pectineus muscle must be raised.*

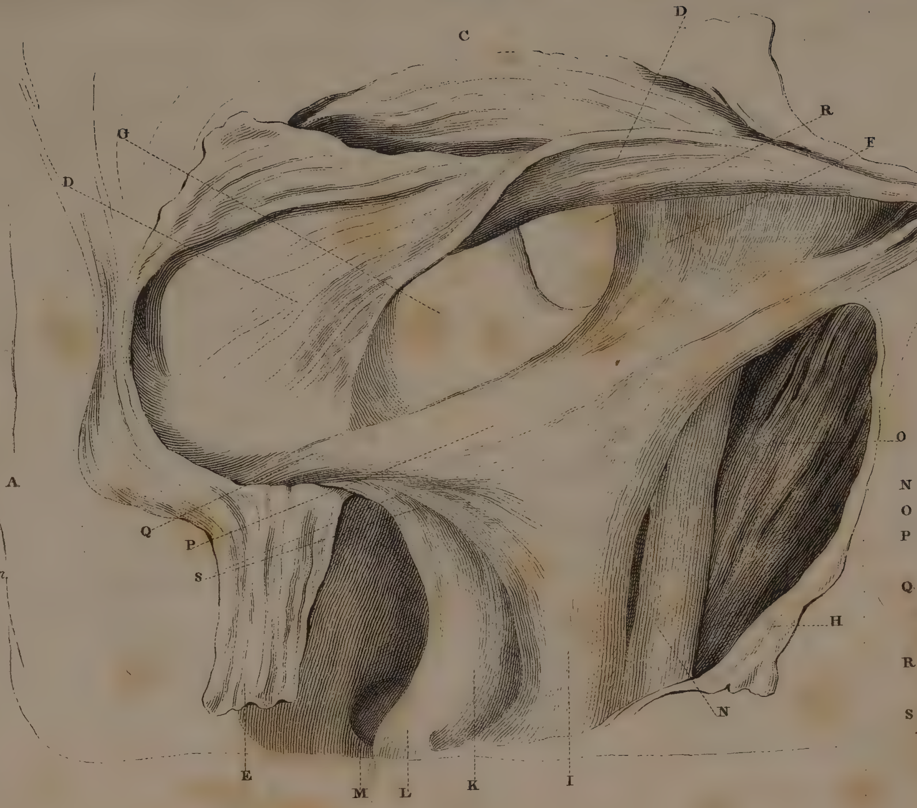
I. *Crural or femoral sheath covering the crural artery and vein.*

K. *Saphæna major vein entering the sheath.*

L. *Iliacus internus muscle.*

M. *Pectineus muscle.*

PL. XII.

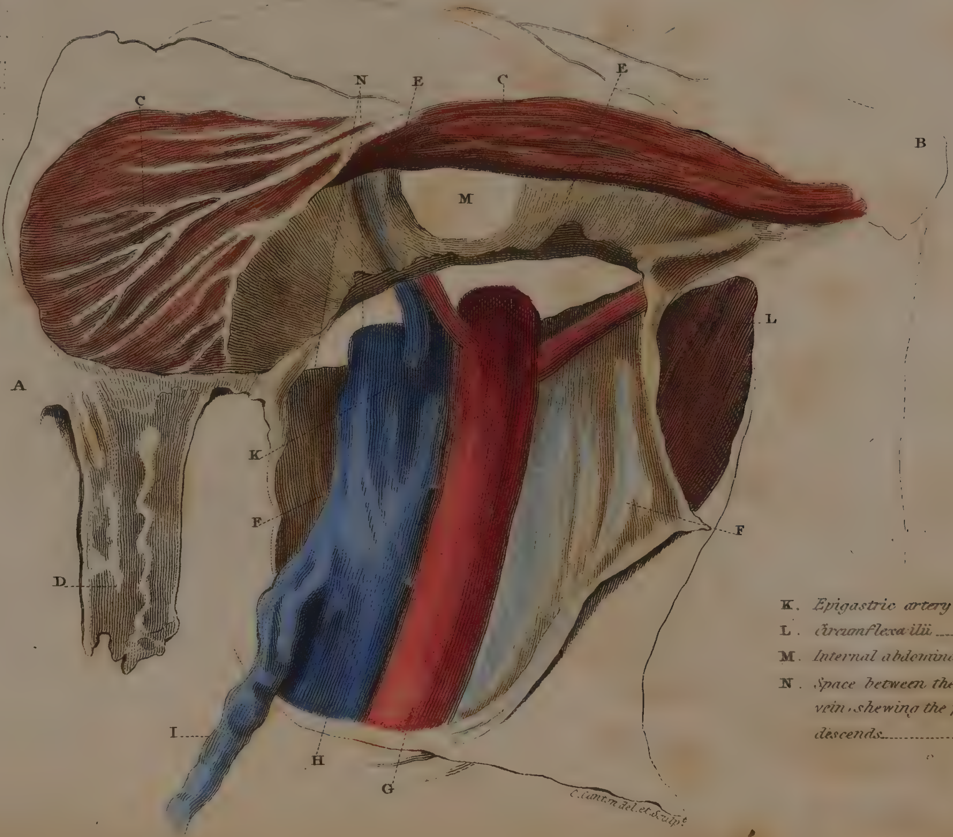


A. *Pubis*
B. *Ilium*
C. *Abdominal muscles*
D.D. *Transversalis muscle & tendon*
E. *Tendon of the external oblique muscle cut through & turned down.*
F. *External portion of the fascia transversalis*
G. *Internal portion of the same fascia*
H. *Fascia lata turned back*
I. *Crural sheath covering the crural or femoral artery*
K. *Crural sheath covering the crural vein*
L. *Saphæna major vein*
M. *Some part of the semilunar edge of the fascia lata*

N. *Anterior crural nerve*
O. *Iliacus internus muscle*
P. *Seat of the crural arch to which the sheath adheres*
Q. *Portion of the crural sheath passing behind the third insertion of the external oblique muscle into the pubis*
R. *Hole in the fascia transversalis for the passage of the spermatic cord*
S. *Two lines which include the spot at which the crural hernia descends & which is situated at the inner and upper part of the crural sheath*

PL. XIII.

B . *Ilium.*
C . *Transversalis muscle & tendon.*
D . *Insertion of the external obliqueturned down.*
EE . *Fascia Transversalis at its inner part the epigastric artery & vein are seen.*
FF . *Sheath cut open.*
G . *Crural artery.*
H . *Crural vein.*
I . *Saphæna major.*



K . *Epigastric artery & vein.*
L . *Circumflexa ilii.*
M . *Internal abdominal opening for the spermatic cord.*
N . *Space between the crural sheath & the crural or femoral vein, shewing the part at which the crural hernia descends.*

PL. XIV.

A. *Os Pubis*... B. *Spine of the ilium*.... C. *Acetabulum*... D. *Thyroid foramen*..........

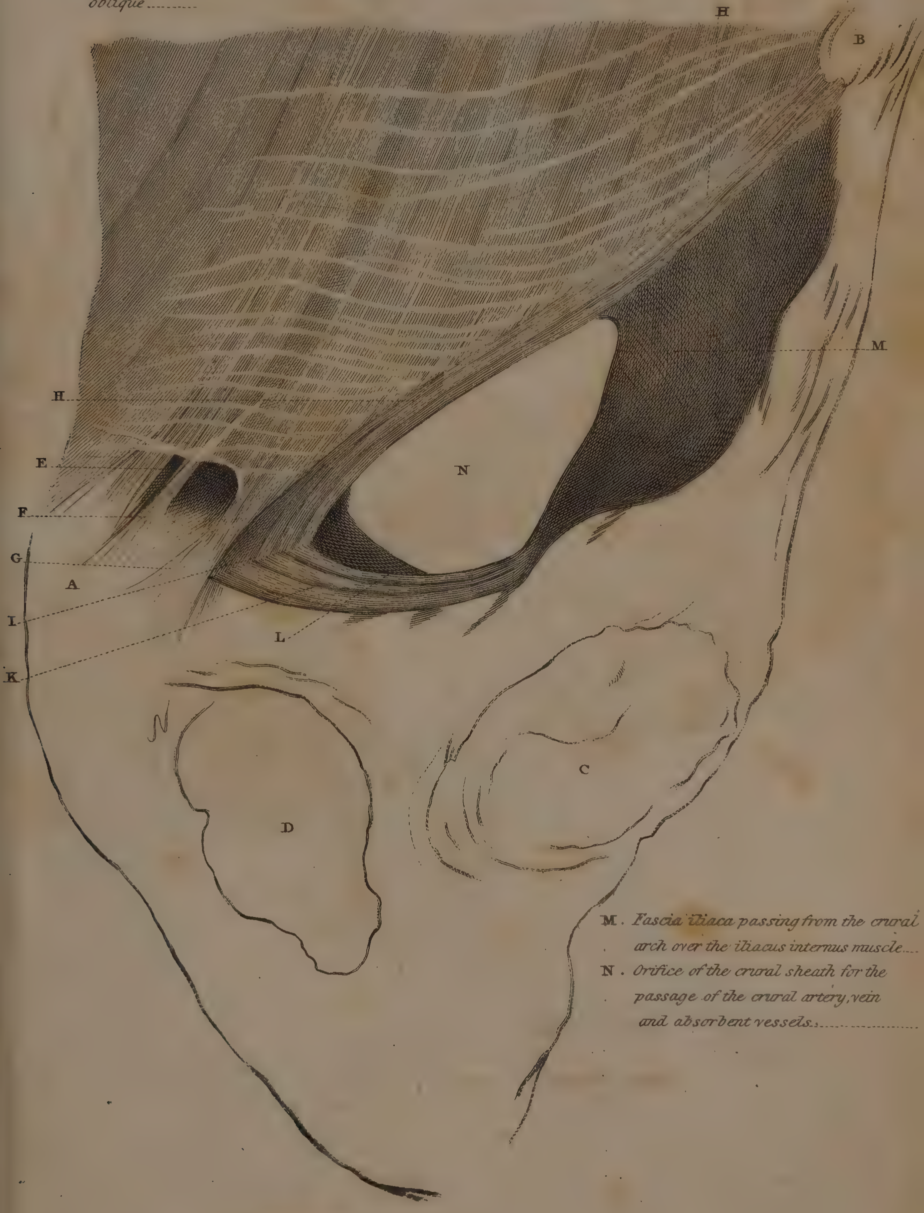
E. *Column of tendon* F. *another column* G. *a third column making together two apertures at the abdominal ring in the female, which is not uncommon*..........

H. *Anterior edge of the crural arch or Pouparts ligament*..........

I. *Third insertion of the external oblique muscle*..........

K. *Ligament of the pubis into which the external oblique* I *is inserted*..........

L. *Portion of fascia transversalis and tendon of the rectus passing behind the insertion of the external oblique*..........



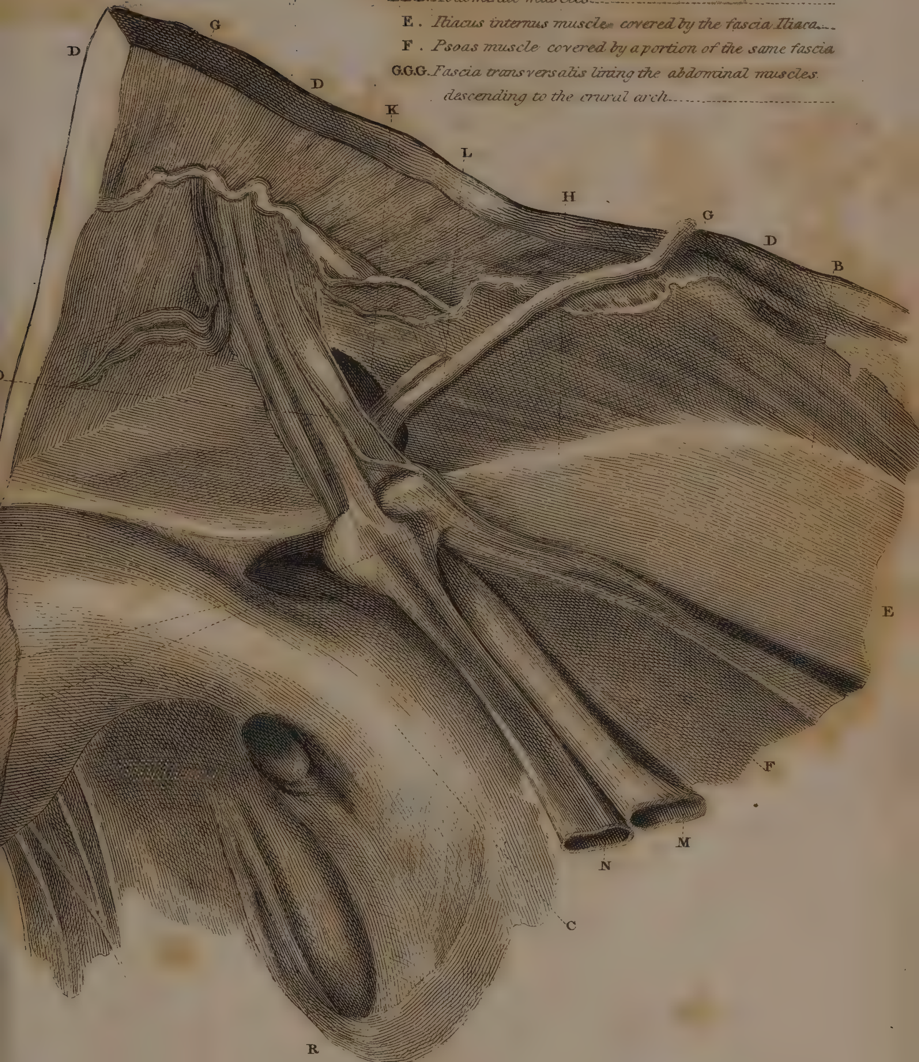
M. *Fascia iliaca passing from the crural arch over the iliacus internus muscle*....

N. *Orifice of the crural sheath for the passage of the crural artery, vein and absorbent vessels*..........

Cannon del. et sculp.

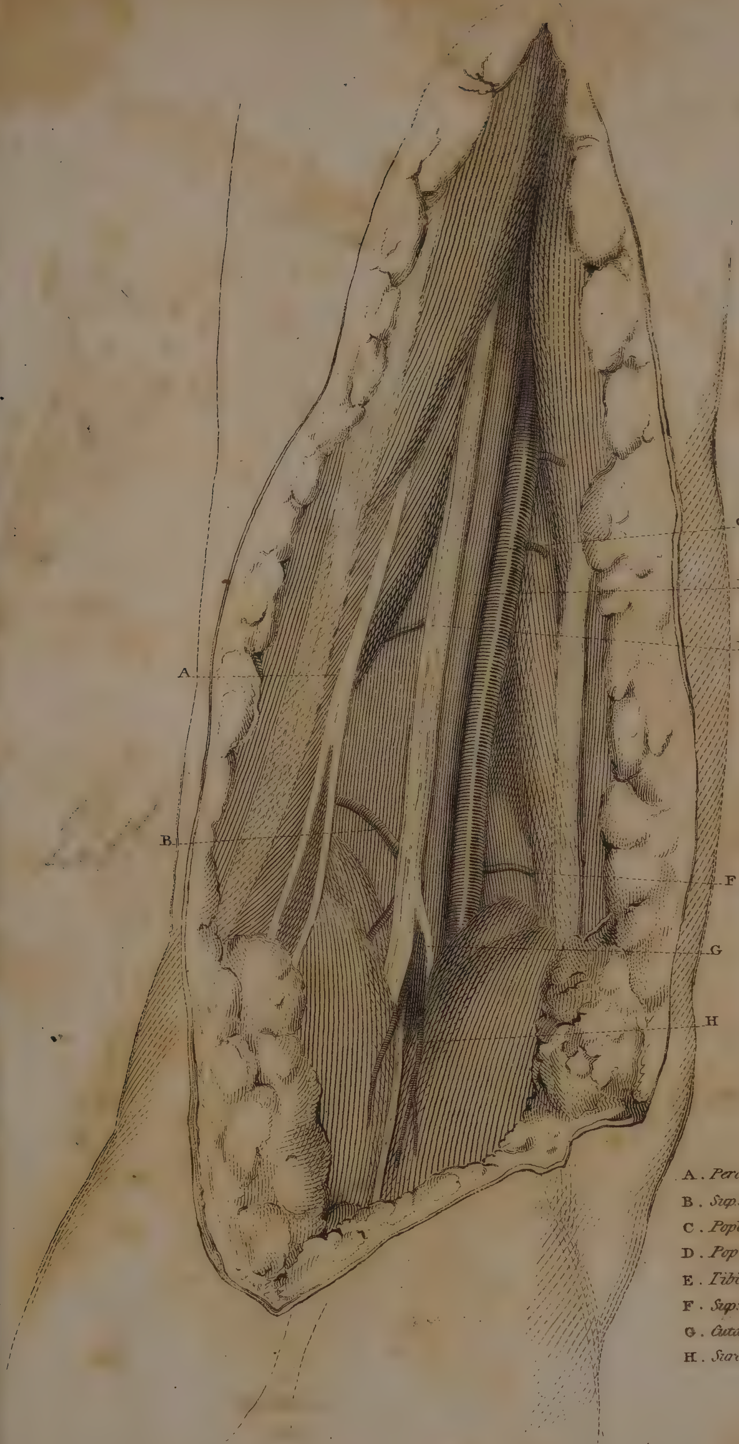
PL.XV.

A. *Symphysis pubis.*
B. *The seat of the spine of the ilium.*
C. *Junction of the pubis & ilium.*
D.D.D. *Abdominal muscles.*
E. *Iliacus internus muscle covered by the fascia Iliaca.*
F. *Psoas muscle covered by a portion of the same fascia*
G.G.G. *Fascia transversalis lining the abdominal muscles descending to the crural arch.*



H. *Poupart's ligament or the crural arch where the two fasciæ join.*
I. *A process of the fascia passing upon the iliac artery and vein uniting them to the edge of the crural sheath.*
K. *Internal abdominal ring or upper aperture of the inguinal canal.*
L. *Spermatic cord passing through that aperture.*
M. *External iliac artery.*
N. *External iliac vein.*
O. *Epigastric artery & vein.*
P. *Third insertion of the external oblique into the pubis covered however by the fascia transversalis.*
Q. *The space by which crural hernia descends the finger having passed into it before the drawing was made to push down the fascia which extends over it.*
R. *The obturator foramen.*

Canton del. et Sculp^{r}



A. *Peroneal Nerve*

B. *Sup: Outer Articular Artery.*

C. *Popliteal Artery*

D. *Popliteal Vein*

E. *Tibial Nerve*

F. *Sup: Inner Articular Artery*

G. *Cutaneous Nerve*

H. *Sinuſes*

J.H.G. del.t

C. Canton Sculp.t

h

Motions of ye Head. Thorax
and Vertebrae - page 133.

Other Muscles + Actions thereof
Respiration &c.
Fascia &c.